

WMS

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August 2009

Ridgiform-XL

Technical guide

Water Management Solutions

Design, planning, specification and installation guidelines

WMS

Polypipe Water Management Solutions the UK's leading supplier of sustainable urban drainage solutions for commercial, infrastructure and residential applications.

Ridgistorm-XL is the latest introduction to the WMS portfolio and provides a full range of large diameter pipes and fittings for use within attenuation and pipeline projects. This manual outlines the features and benefits of the Ridgistorm-XL system and provides advice and guidance regarding the design, installation and general properties of the system.

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Notes for technical drawings

The following notes apply for the technical drawings in this document:

- All dimensions are in millimetres unless otherwise stated
- All temporary and enabling works by others
- Refer to Polypipe Water Management Solutions for unit details
- All pipe connections and inspection points are assumed unless otherwise specified
- All dimensions of fabricated items are nominal and may vary within manufacturing tolerances
- A drawing is intended for guidance only. Confirmation of the information contained in a drawing should be sought from the consulting engineers before construction activities take place

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The document is presented in clearly marked sections to help you navigate and find the information you require quickly and easily.

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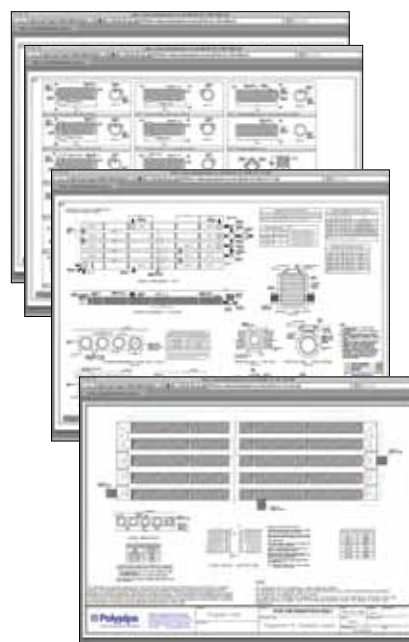
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For updates and a pdf of this document go to www.polypipewms.co.uk/downloads

*Please note: Illustrations shown within this publication are available as downloadable CAD drawings from: www.polypipewms.co.uk



Introduction

Polypipe WMS provides a full range of Water Management Solutions and are able to offer you unbiased advice and guidance as to the appropriate solution for your specific project.

Polypipe

Polypipe

Polypipe

Intended Audience

- Civil Engineers and Architects who design and specify attenuation and infiltration systems.
- Contractors who install Ridgistorm-XL large diameter pipes.

Purpose of this document

This document provides full technical details on Polypipe WMS Ridgistorm-XL products and explains how to:

- Select products to provide the best solution for your specific stormwater requirements.
- Incorporate products into your project's design.
- Install products on-site.

Health and Safety at Work

The Health and Safety at Work Act and the regulations under it apply to SUDS schemes. All Polypipe WMS products should be transported, handled and installed in accordance with the requirements of BS5955:Part 6:1980 and, for applicable contracts, the Highways Agency's Manual of Contract Documents for Highway Works and Sewers for Adoption.

Construction (Design and Management) Regulations 2007

Apart from very small projects, where the clients are typically householders, the Construction (Design and Management) Regulations 2007 apply to the planning, design, construction and maintenance of SUDS schemes. The Regulations emphasise the importance of considering health and safety for a construction project during the project's design phase.

Holistic Solutions

Holistic solutions from the market leaders in surface water management

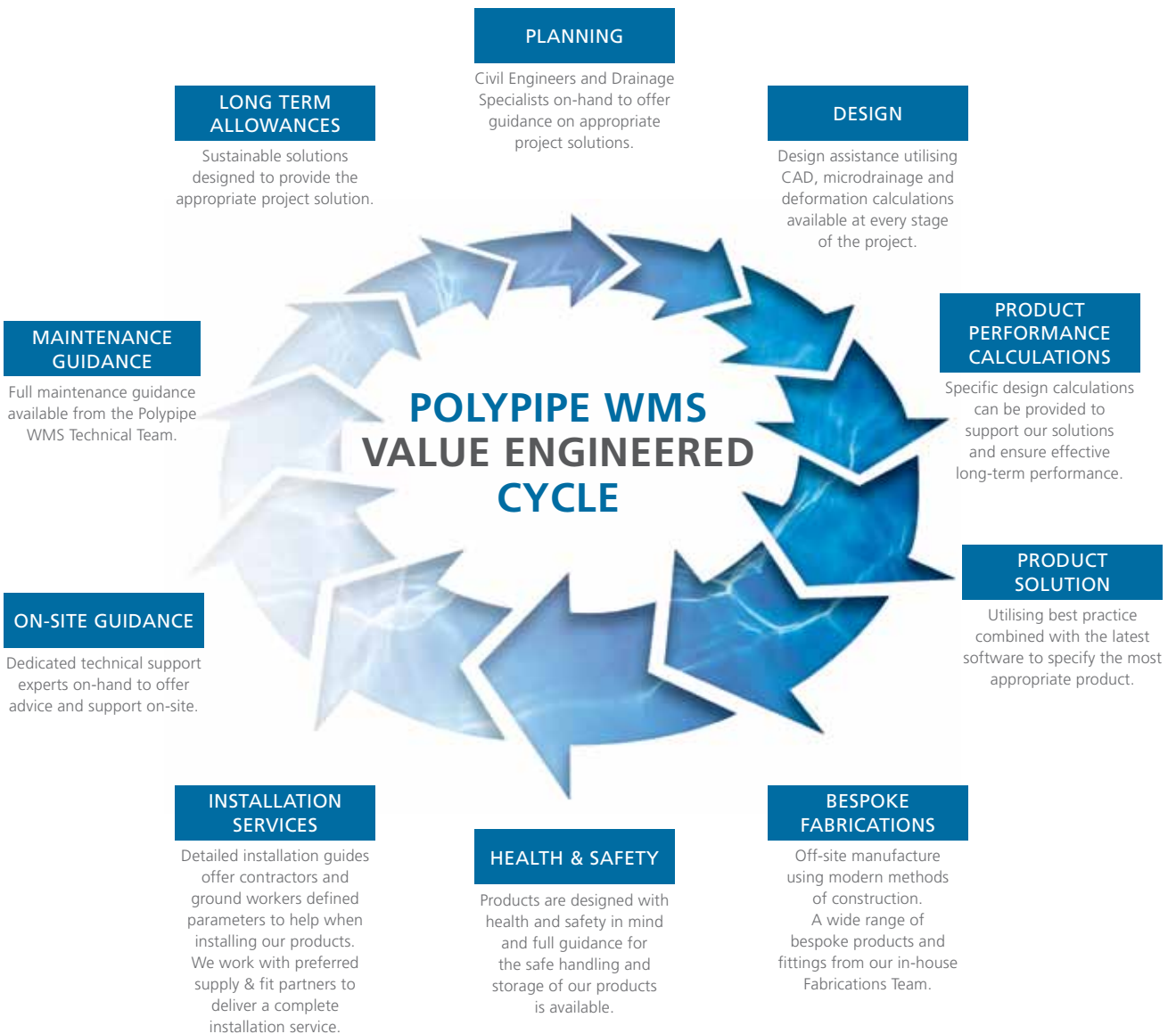
Our Approach

Polypipe WMS is the only manufacturer of water management products to offer a complete range of solutions from large diameter pipes to modular cell systems, flow control devices and filtration units. This approach enables you to take advantage of bespoke solutions designed for a specific project and value engineered to your exact requirements.

Dedicated Support

Our team of fully qualified Drainage Specialists, Civil Engineers and Technical Support experts also provide invaluable experience and knowledge through each stage of a project.

Contact our Technical Team on **01509 615100** or go to www.polypipewms.co.uk/technical-support/.



Sustainable Drainage Systems (SUDS)

Sustainable Drainage Systems (SUDS) is the alternative to the traditional approach of collecting stormwater in pipes and discharging it into sewers or watercourses.

1. SUDS Best Practice

The SUDS Manual, published by CIRIA 2007 (CIRIA C697) defines that a sustainable urban drainage system should consider certain basic requirements, including:

- Run-off from a developed area should be no greater than the run-off prior to development.
- Run-off from a developed area should not result in any down-grading of downstream watercourses or habitat.
- Consideration should be given at the development feasibility stage to water resource management and control in the developed area.
- Run off should replicate as far as possible the natural response of the site to rainfall.

SUDS best practice limits the flow of rainwater which runs off a site or is piped away, protects local watercourses from contamination carried in surface run-off, encourages natural groundwater recharge (where appropriate) and reduces the likelihood of downstream flooding.



1.1 Building Regulations

The Building Regulations Approved Document H3, Rainwater Drainage, which came into effect on 1st April 2002, prioritises drainage requirements. In short, it requires that rainwater from the roof of a building or from a paved area may either be gathered for re-use in a rainwater storage tank or be discharged into one of the following, listed in order:

- (a) an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practical,
- (b) a watercourse; or, where that is not reasonably practical,
- (c) a sewer.

SUDS incorporate various cost-effective techniques that are applicable to a wide range of schemes, from small developments to major commercial, industrial, residential or leisure operations with large roof spaces and large hardstanding areas. They can also be successfully retrofitted to existing developments. Planning policy guidance on development and flood risk emphasises the role of SUDS and introduces a general presumption that they will be used. As with other key considerations in the planning process - transport, landscape, heritage and nature conservation - incorporating SUDS needs to be considered early in the site evaluation and planning process, as well as at the detailed design stage.

In other words, the traditionally preferred method of rainwater disposal, i.e. totally discharging to a sewer, may now only be considered after other forms of re-use or drainage have been considered and shown to be impractical for a given site.

The Building Regulations also provide guidance on the construction of rainwater harvesting systems for the first time. The Code for Sustainable Homes indicates the Government's intentions to further drive developers towards building sustainable homes. As well as covering energy efficiency, water usage and waste, the code also proposes a minimum standard for surface water management. This minimum standard will require peak run-off rates or annual run-off volumes of surface water to be no more than the original conditions of the site. The challenge each developer faces on both greenfield and brownfield developments is what to do with the excess run-off generated by development which has to be retained in and around the site. Soft SUDS alone may not provide sufficient storage on certain sites due to space constraints, particularly driven by the housing density requirements in PPS3: housing. In these situations engineered solutions provided by Polypipe can be used or combined with the soft solutions to provide an effective and integrated water management system.

Polypipe Water Management Solutions provides to both the large and small developer, flexible solutions which cater for almost any site conditions and restraints.

1.2 Sustainable Drainage Planning

Many authorities will expect planning applications, whether outline or detailed, to demonstrate how a more sustainable approach to drainage is to be incorporated into development proposals.

1.2.1 Planning

The Environment Agency will set a limit to the rate and volume of stormwater flow from a site via sewers as a condition of planning consent. In recognition of this, Local Planners increasingly state that all applications should, in the first instance, aim to incorporate SUDS into development proposals. SUDS are also considered suitable for mitigating adverse impacts and supporting water conservation objectives.

1.2.2 Adoption and Future Maintenance

In the early stages of design, consideration should be given to the arrangements for adoption and future maintenance of the system. This is likely to influence the design just as much as technical considerations. For private, or non-adopted systems, maintenance will be the responsibility of the owner and future developments may be affected by covenants.

For systems serving more than one residential property it is recommended that maintenance should be the responsibility of a publicly accountable body, which will often necessitate the payment of a commuted sum or a legal agreement, possibly backed by the deposit of a financial bond. The adopting organisation should approve the design before construction.



Introducing Ridgistorm-XL

Ridgistorm-XL

Advanced technology from Polypipe

Ridgistorm-XL is the latest innovative solution to SUDS and stormwater management requirements.

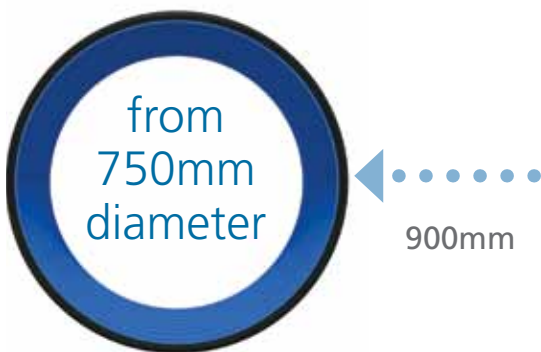
Combined with the technical expertise, knowledge and support of Polypipe Water Management Solutions (WMS), Ridgistorm-XL is designed as a bespoke application for each project and offers the most advanced large diameter plastic pipe solution available in the UK.



Ridgistorm-XL

2.1 Bespoke Project Design

Ridgistorm-XL is designed as a bespoke solution to suit each individual project. Our team of Design Engineers and Drainage Specialists utilise the latest design and manufacturing techniques to engineer a drainage system to your exact requirements. This flexibility enables us to design-in required elements such as inspection chambers and manhole access at determined intervals.



2.2 Applications

With a range of diameters from 750mm to 2100mm, Ridgistorm-XL offers a durable and engineered solution to large-scale attenuation and pipeline requirements for use in:

- Surface water drainage.
- Large-scale attenuation structures.
- Specialist pipeline applications.
- Foul sewers.
- Bespoke large diameter manholes and chambers.

(See page 17 for details).

2.3 Jointing

Ridgistorm-XL can be designed to suit any jointing requirements on-site.

- Electro-fusion.
- Extrusion welding.
- Rubber seals.
- Flange connection.

(See page 16 for details).

2.4

Bespoke Pipe Profile Providing Individual Stiffness Class

Ridgistorm-XL can be engineered to suit any application. By analysing the site conditions and installation parameters, our Design Engineers can create a solution with the appropriate profile strength and stiffness that is neither over nor under engineered. Our production flexibility allows pipe strength to be produced at varying stiffness classes to meet the design requirements of a project. This removes the need to step-up pipe specification. (See section 3 for full details).

6 metres (typical)



2.5

Exceptional Leak Tightness

Ridgistorm-XL is designed as a flexible structure to minimise the effects of ground movement and deformation and prevent leakage from the pipeline or attenuation structure. Exceptional pipeline integrity is achieved with Ridgistorm-XL due to the reduced number of joints, therefore minimising the number of potential leakage points and removing the risk of groundwater pollution.

Ridgistorm-XL*



Concrete**



* Based on standard 6m length, other lengths available on request

2.6 Ridgistorm-XL versus Rigid Materials

Ridgistorm-XL offers a robust, durable and adaptable solution in comparison to rigid materials such as concrete and steel. Due to its longer lengths and lighter weight, Ridgistorm-XL can be 70% cheaper to transport than equivalent size concrete pipes and can be handled and stored much more safely on-site. (see page 19 for further details on the benefits of plastic pipes).

2.7 Pipe Length

Ridgistorm-XL can be supplied in anything from 1-6m as standard. Longer lengths may be available on request.



2.8 Standards and Approvals

Ridgistorm-XL is approved by WRc (see page 17 for details) and is designed to meet the performance requirements of the European Sewer Pipe standard BS EN 13476. Ridgistorm-XL also meets the requirements of DIN 16961. As the approval process is ongoing please visit our website for the latest information www.polypipewms.co.uk or call **01509 615100**.



**Based on 2.5m length concrete pipe

- 100% recyclable
- Ideal for use as large-scale attenuation system
- Strong yet flexible design
- Able to withstand ground movement without leakage
- Superior hydraulic performance achieved through smooth bore
- Durable materials
- Excellent resistance to sulphate and chemical attack
- Longer pipe lengths for improved pipeline integrity and fewer joints
- Excellent load bearing capability

up to 2100mm diameter

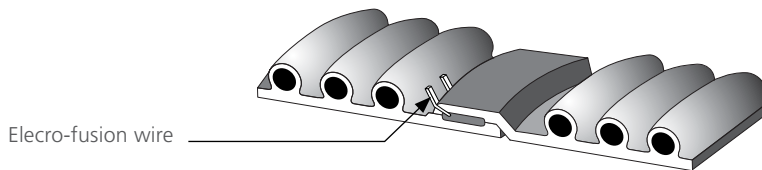
Jointing

2.9 Multiple Jointing Options

Ridgistorm-XL can be designed and manufactured to suit any jointing requirement on-site. Electro-fusion welding, extrusion welding, flange connections and rubber seal connections can all be achieved with the Ridgistorm-XL system, depending on the installation and application requirements of the project.

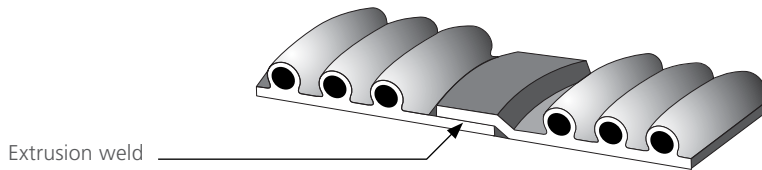
2.9.1 Electro-fusion

This system is the preferred joint system as the whole pipe system effectively becomes a homogeneous unit and 100% seal tightness can be achieved to guarantee exceptional joint and pipe performance. Electro-fusion wire is connected to the socket end of the pipe during manufacture. See full details in section 4.



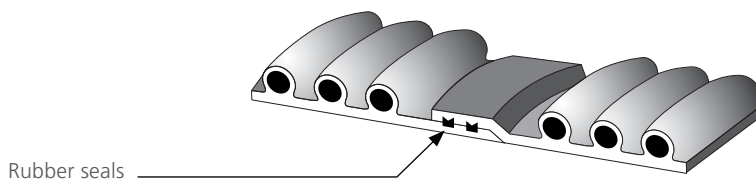
2.9.2 Extrusion Welding

Pipes and/or fittings are jointed with an extrusion welding device. The jointing method can be carried out inside and/or outside the pipe. This jointing is most suitable for low-pressure gravity pipes and manholes. According to DVS 2207 part 4.



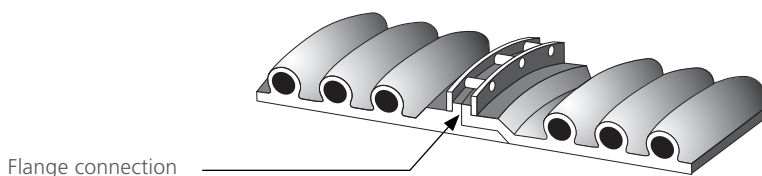
2.9.3 Rubber Seals

This connection uses the socket and spigot jointing with two SBR rubber seals which are installed into the spigot end of the pipe or fitting. This method allows pipes to be separated in the future if necessary. Available for 750-1200mm diameter pipes. Meets the requirements of BS EN 1277. Nitrate seals are available, but are subject to lead times.



2.9.4 Flange Connection

The ends of pipes and fittings are manufactured with circular flanges, jointed with the help of a steel flange and rubber gasket. This is a special connection, please contact the technical department for further details on [01509 615100](tel:01509615100).



2.10 WRc Approval

Ridgistorm-XL and all pipe profile options, stiffness classes up to SN2 to SN8 and diameters from 750 to 2100mm are approved by WRc. The approval also extends to all work carried out by Polypipe's in-house Fabrications Department, the design software used to engineer the product (for SN1 - SN8) and Ridgistorm-XL's unique and patented electro-fusion jointing method, which covers the tensile strength of each joint, the jointing method and Polypipe's installation manual and guidance. As the approval process is ongoing please contact us for the latest information on **01509 615100**.



2.11 Applications for Ridgistorm-XL

Ridgistorm-XL pipes can be engineered to suit a wide range of applications, from pipelines for surface water drainage and foul sewer schemes, to attenuation structures and large diameter manholes and chambers. As a value engineered product, each Ridgistorm-XL pipe is designed to minimise material and provide cost savings to the client. Ridgistorm-XL is lightweight compared to traditional, rigid materials and is typically 6% of the weight of an equivalent concrete pipe, making it easier, safer and quicker to handle and install. See case studies of the following applications on pages 64 & 65 and further recent stories at www.polypipewms.co.uk/projects/.

2.11.1 Surface Water and Foul Drainage Systems

Ridgistorm-XL pipes can be used in foul, CSO applications and surface water sewer systems for use under Section 104 Adoption Agreement. Adoption of the system should be checked with the appropriate water company.

Applications

2.11.2 Attenuation Structures

Polypipe WMS can supply both small and large scale attenuation systems to meet the exact requirements of a project. Ridgistorm-XL attenuation solutions feature a tank structure engineered and manufactured from large diameter pipe in a range of sizes from 750 to 2100mm. The product can also be pre-fabricated with the option of welded end plates or bespoke manifolds by Polypipe's in-house Fabrications Department.

Surface water run-off from roofs, roads or car parks can be stored in below ground, engineered structures, ready to release within a set discharge limit. The Stormcheck 'Vortex' Flow Control Chamber (see page 67) comprises a pre-fabricated plastic chamber in a range of diameters, with an integral vortex flow control device to allow precise control of surface water discharge rates from site. The ingress of debris and silt within the attenuation structure is prevented by Polypipe Silt Traps which can be designed and fabricated from Ridgistorm-XL large diameter pipe to suit any drainage scheme.



2.11.3 Soakaway/Infiltration

The Building Regulations Approved Document H3, Rainwater Drainage, prioritises an adequate soakaway as the first consideration for rainwater discharge (see page 10). Ridgistorm-XL pipes can be perforated to suit the requirements of any soakaway or infiltration project.

2.11.4 Rainwater Harvesting

Rainwater harvesting tanks can be pre-fabricated from Ridgistorm-XL in diameters from 750 to 2100mm to deliver a range of tank sizes. These are ideal for rainwater re-use applications, including education and commercial projects and benefit from off-site construction and arriving on-site ready for installation.

2.11.5 Sea Outfalls

Ridgistorm-XL pipes are resistant to seawater. This material strength combined with its unique and patented electro-fusion jointing system makes Ridgistorm-XL ideal for sea outfall projects as a homogenous pipeline can be achieved, guaranteeing an exceptional joint.

Benefits of Plastic Pipes

2.12 Benefits of Plastic Pipes

2.12.1 Environmental Benefits

Plastics, which feature among the most researched materials in the world, are an integral part of sustainable developments. Thinner, lighter and more robust than most rigid materials thanks to continuous technological innovation, plastic pipes **typically weigh 94% less than their concrete equivalent**. Due to their lightweight nature, plastic pipes and fittings help to **reduce energy use** and therefore greenhouse gas emissions.

Using plastic also reduces the need for quarrying activities, and because of their lightweight nature, plastic pipes can be **transported in greater volumes** than their concrete equivalents. For example, 1 km of 900mm plastic drainage pipes from Polypipe will only require **17 deliveries** compared to concrete pipes which would require **29 deliveries** to site. Not only will the reduced number of deliveries provide environmental benefits, such as **reduced CO₂ emissions** but the reduction in vehicle movements on-site also ensure that the associated **Health and Safety risks are reduced**.

Polypipe produces pipes and fittings utilising recycled materials where appropriate, even when the integrity of the system requires products to be manufactured from prime materials the products are **100% recyclable** at the end of their useful life.

The table below shows a comparison of CO₂ emissions for plastics, concrete and metal pipes from cradle (manufacture) to gate (before transportation to the consumer). For example, the CO₂ emissions for 1500mm diameter concrete pipes at 287.49/ft is over three times that of the plastic pipes even before delivery to the consumer.

Pipe size (mm)	High density polyethelene		Reinforced concrete pipe		Corrugated metal pipe	
	WT/foot	CO ₂ /ft	WT/foot	CO ₂ /ft	WT/foot	CO ₂ /ft
300	3.34	6.69	93	20.65	10	28.20
375	4.74	9.49	127	28.19	12	33.84
450	6.59	13.19	168	37.30	15	42.30
600	11.30	22.59	264	58.61	19	53.58
750	15.83	31.65	384	85.25	24	67.68
900	20.35	40.70	524	116.33	36	101.52
1050	29.24	58.47	686	152.29	42	118.44
1200	32.05	64.10	867	192.47	65	183.30
1500	46.36	92.72	1295	287.49	103	290.46

Note:

All CO₂ production is listed as 'cradle to gate'.

CO₂ Per unit data obtained from 'inventory of Carbon & Energy (ICE)', University of Bath, UK.

Project was funded by the Carbon Trust & EPSRC (Engineering & Physical Sciences Research Council), the UK government's leading funding agency for science and engineering.

Table 2.12-1 Comparison of CO₂ emissions

2.12.2 On-site Benefits

As plastic pipes are inherently **lightweight** they are **quicker and easier to install** than when utilising rigid materials such as clay or concrete. Lighter plant hire is required therefore providing **cost savings on-site**. Further cost savings are achieved as lighter plant removes the need for temporary access works and prevents damage to road surfaces. Plastic pipes can be 70% **cheaper to transport** than equivalent concrete pipes due to their longer lengths and light weight. The lightweight nature also provides **excellent Health and Safety benefits** when considering the storage and handling of pipes, making them beneficial to CDM compliance, see page 44.

Polypipe WMS benefits from its own in-house fabrications facility which allows us to work in partnership with our customers to provide bespoke drainage solutions. We are committed to designing out cost and therefore time on-site, through the effective use of pre-fabricated solutions manufactured off-site and delivered ready for installation.



2.12.3 Performance Benefits

Typically, Ridgistor XL pipes are supplied in 1-6m lengths, although longer lengths are possible. Concrete pipes are usually supplied in 1m or 3m lengths. Using plastic pipes ensures that **fewer joints** are required along the pipeline, therefore **minimising any potential leakage points**. The flexible nature of plastic pipes ensures that they are **more tolerant to deformation and movement** of the surrounding soil than rigid pipes, further minimising the risk of leakage, a key factor when considering the Water Framework Directive European legislation and the new Groundwater Directive which puts a reduction in diffuse pollution of groundwater as a critical objective.

2.12.4 Plastic Pipe Solutions Benefits at a Glance

- Lower density and weight than rigid materials, so lower transport and installation costs.
- Strong yet flexible with reduced risk of breakage.
- Strong and lightweight providing excellent Health and Safety benefits.
- Plastic pipe installations have reduced leakage compared to rigid materials because of longer pipe lengths and high-integrity joint systems.
- Can be manufactured from recycled materials.
- Proven second life - 100% recyclable.
- Ability to use as-dug materials in certain applications.
- Ability to use off-site construction techniques to minimise cost and time on-site.
- Non corrosive.
- Chemically resistant.
- Flexible pipe providing increased ability to withstand ground movement.
- High resistance to site damage under normal usage conditions.
- Structured wall engineered design with maximum system strength but minimum product weight and cost.

Design



Our team of fully qualified **Drainage Specialists, Civil Engineers and Technical Support** experts provide invaluable experience and knowledge at design stage.



Design

3. Design

This section explains the structural performance of flexible pipes compared to rigid pipes and details how Ridgistorm-XL can be value engineered to site specific requirements and demonstrates general arrangements of the Ridgistorm-XL system along with the available units and fittings.

3.1 Pipe Structural Performance

Pipes are typically categorised as rigid or flexible, depending upon the material from which they are manufactured. Rigid pipes, such as concrete, have a high inherent strength and resist applied loading by a bending action within the pipe walls. They are generally stiffer than the pipe surround material, in particular the sidefill and consequently support a higher load than the sidefill material. For design purposes, they are generally assumed to support the entire vertical load transmitted through the backfill material placed above the level of the pipe crown. (See Figure 3.1.1B).

3.1.1 Failure of rigid pipes occurs when the vertical loading exceeds its load capacity and causes fracture of the pipe wall (figure 3.1.2B). In order to perform satisfactorily the pipe must therefore be strong enough to support the design loading, in addition to being laid on a stiff bedding material, which must ultimately support the loads transmitted through the pipes. The bedding must not allow differential settlement of the pipeline to occur, since this would result in stress concentrations in the pipe wall and result in failure.

3.1.2 Compared with rigid pipes, flexible pipes are versatile and have important structural performance advantages. Unlike rigid pipes, flexible pipes have excellent resistance to differential settlement. Plastic pipes, when overloaded, will simply deform (figure 3.1.2A) further to generate greater passive earth pressures until the system regains equilibrium.

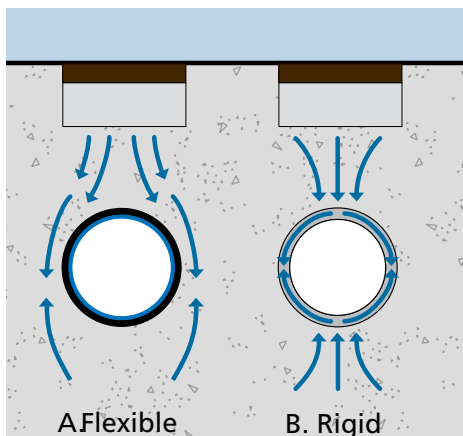


Fig. 3.1.1 Performance mechanisms

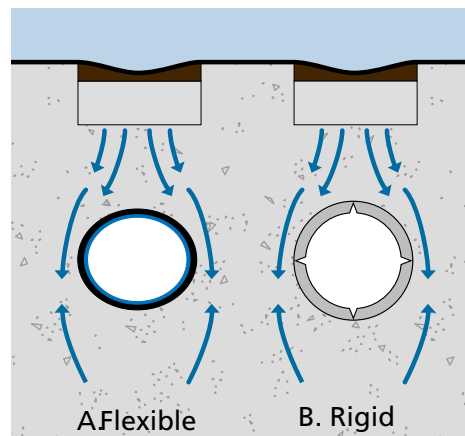


Fig. 3.1.2 Overloading effect

As a consequence of the differing performance mechanisms, flexible pipes have structural performance advantages over rigid pipe systems.

- Flexible pipes offer excellent resistance to differential settlement.
- When overloaded, rigid pipes are subject to fracture and failure of the system. Plastic pipes, when overloaded, will deflect further to generate greater passive earth pressures until the system regains equilibrium.

3.1.3 Pipe Deformation

The deformation of flexible pipes under load results in the ovalisation of the pipe (typically a 1-4% reduction in the vertical diameter and an increase in the horizontal diameter). As the horizontal diameter of the pipe increases, it derives support from the sidefill and trench wall. This passive earth pressure increases as the pipe deforms further until the pipe-soil system comes into equilibrium.

Further deformation will not occur thereafter unless a higher vertical load is applied to the pipe-soil system or consolidation (or creep) of the materials occurs over a long period of time. It is internationally recognised that when a pipe is installed in accordance with an appropriate code of practice, increases in deflection virtually stops after a short period of time. The duration of time is dependent on soil and installation conditions but generally less than two years.

3.1.4 Serviceability Limits

Deformation of flexible pipes must occur if the pipe-soil system is to reach equilibrium.

Therefore deformation is not detrimental but a natural action allowed for in flexible pipe design.

European testing on flexible pipes has shown that pipe deformations of more than 30% can occur in practice without signs of structural failure.

However, it is accepted that a limit on vertical deformation is necessary to ensure adequate long term pipe performance. Appropriate deflection (serviceability) limits should be set on a case by case basis. For example, greater limits may be allowable in a deep landfill installation compared to a pipe buried at shallow depth under a road.

Deflection limits within the UK varies, depending on the relevant adopting authority. For design purposes the Highways Agency specifies a maximum allowable deformation of 5% for thermoplastic structured wall pipes, while the water industry tends to specify 6%.

Polypipe WMS are able to perform calculations using the design protocol EN1295, to design and check that the pipe deformation will not exceed individual project requirements.

3.2 Unique Pipe Stiffness Technology Providing Flexible and Variable Loading Specifications

Polypipe WMS is unique in its ability to produce large diameter pipe and attenuation solutions to match your exact requirements and site conditions. The flexibility of our manufacturing process enables you to specify exact stiffness requirements and utilise a value engineered solution that is neither under nor over specified.



Design

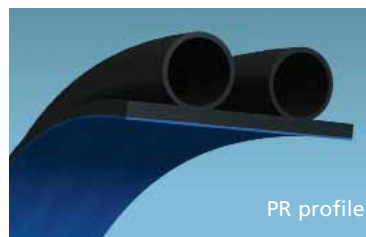
3.2.1 Individual Pipe Profiles

Following many years of development, structured wall pipe technology has been designed and engineered to maximise the strength of the pipeline. Utilising the latest manufacturing technology and unique, state of the art software enables Polypipe WMS to create unique profile designs to match customers' site requirements. Pipe profile designs can be adapted to maximise strength and minimise use of material within the pipeline, which improves pipeline performance and provides a value engineered solution.

Our bespoke range of profiles are integral to the strength and performance of the pipeline. Optimised wall thickness and pipe profile design ensures that the pipeline can cope with both external and internal pressures and any subsequent deformation. Ridgistorm-XL is designed as a flexible structure to withstand imposed loading and ground movement once installed.



Profile type VW enables the production of a solid pipe with a smooth inner and outer surface. These pipes can be produced with a wall thickness of 5mm to 80mm.



Pipes produced with a PR profile achieve high stiffness with relatively low weight. This is a common pipe profile for use in sewer and surface water drainage applications and attenuation.



In addition to the PR profile, the Olympia profile option can achieve greater pipeline stiffness with a comparatively low weight.



This profile option has a smooth inner and outer surface, including internal profile to one layer. High stiffness is achieved through the SQ profile, making it ideal for extremely high loads or larger diameters.



SQ2 offers the same benefits as the single-layer SQ profile, yet it can be produced with additional profile layers for added ring stiffness and exceptional loading for deep burial and specialist applications.

3.3 Value Engineering

Historically the ring stiffness of plastic structured wall pipes have typically been SN8 to allow for all project requirements. In many applications this is over specified. The flexibility of the Ridgistorm-XL system allows site specific assessments to be carried out to determine the exact ring stiffness required with a potential project saving of up to 35%* on material costs.

A granular bed and surround detail is standard for the installation of the Ridgistorm-XL system. However, by using the unique Easypipe software, Polypipe WMS are able to engineer alternative trench bed and surround details to ensure the most cost effective and optimum construction to suit each individual project. The WMS Technical Team is able to assist in performing design checks to ensure that the proposed pipe design is suitable for the site specific conditions.

Unlike traditional rigid pipe systems, flexible pipes do not have a specific crushing strength but a ring stiffness. Therefore the long term performance of a flexible pipe system is typically based on a maximum allowable pipe deformation (i.e. serviceability limit state style analysis, as opposed to ultimate limit state analysis; (refer to page 25).

The flexibility of the Ridgistorm-XL manufacturing process allows engineers to derive a minimum pipe specification for any given site conditions and specified performance limit; thereby allowing the specification of a Ridgistorm-XL pipe to be optimised to give the most cost effective solution. Polypipe WMS utilises Easypipe, a proprietary software package to derive the optimum Ridgistorm-XL unit properties for any proposed installation. In extensive use across the world, Easypipe is based on the German Association for Water, Wastewater and Waste standard ATV-DVWK-A 127; 3rd Edition; 'Static Calculation of Drains and Sewers'.

It should be noted that ATV-DVWK-A 127 is the established method of structural design of buried pipelines, referenced within the German national annex of EN1295. The software enables multiple load cases to be analysed simultaneously, along with real time assessment of variations in installation parameters. Polypipe WMS are then able to supply a print-out from Easypipe, detailing the assumed installation conditions and the results from the various structural assessment proofs. Polypipe WMS are also able to assist in undertaking design checks in accordance with the UK annex of EN1295-1.

3.3.1 Information Required

The following details are required in order to offer our value engineering service:

- Native ground properties (i.e. stiffness of the soil in which the trench is cut).
- Imposed dead load (i.e. depth and density of the overburden).
- Imposed live load (i.e. loads due to vehicle trafficking).
- Hydrostatic loads.
- Pipe bedding detail.
- Specified allowable maximum limit of deflection.

Please contact the Polypipe WMS Technical Team for further information on [01509 615100](tel:01509615100).

*Based on the average difference between Ridgistorm-XL SN2 and SN8 6 metre pipe.

General Arrangements

3.4 Ridgistorm-XL General Arrangements

The Ridgistorm-XL system may be utilised in standard pipe runs (between manholes), or to form dedicated storage structures. Where storage structures are required, Polypipe's experienced Fabrications Team are able to offer a wide range of fitting options to meet clients' requirements. The following section offers an insight into the range of standard and bespoke fittings that are available from Polypipe WMS. Please feel free to contact the Polypipe WMS Technical Team, who will be happy to discuss the various options available.

3.4.1 Standard Pipe Run

Where additional storage needs to be incorporated into a proposed (or existing) drainage system, the system layout may allow engineers to oversize certain pipe runs to form what are commonly known as 'tank sewers'. Table 3.4-1 summarises the storage capacities of the current range of Ridgistorm-XL pipes:

Ridgistorm-XL dimensions and storage capacities				
Pipe Ø (mm)	Standard length dim 'x' (m)	Nominal O.D. (mm)	Nominal storage volume (m ³ /m)	Nominal I.D. (mm)
750	6	766	0.460	883
900	6	914	0.656	1040
1050	6	1065	0.890	1215
1200	6	1200	1.130	1320
1500	6	1500	1.767	1646
1800	6	1800	2.544	1954
2100	6	2100	3.463	2302

NOTE: Based on a pipe ring stiffness classification of 2.0kN/m². OD will vary if other ring stiffness classification is used. Unit lengths are from 2 - 6m in 0.25m steps.

Table 3.4-1 Ridgistorm-XL dimensions storage capacities

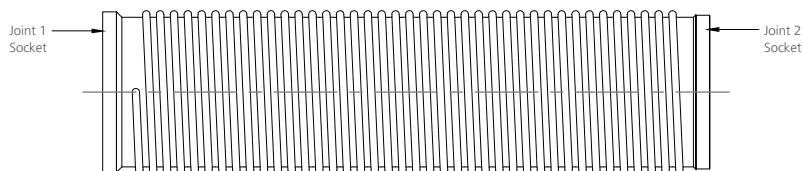


Figure 3.4.1 Standard pipe length

3.4.2 Attenuation Structures

The Ridgistorm-XL system may be used in various arrangements to provide a specified design storage structure. Various manhole, inspection turret and pipework connections are available. Due consideration should be given to ventilation of attenuation storage systems whether this is via manholes or dedicated vents.

3.4.3 General Arrangement Example 1

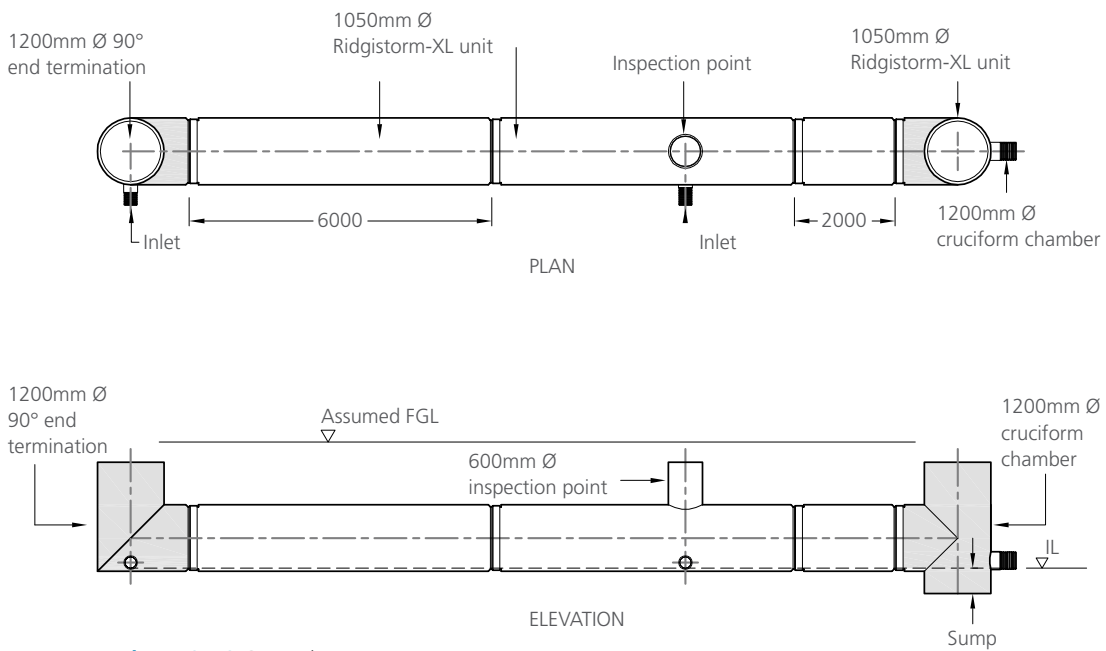


Figure 3.4.3 General arrangement 1

3.4.4 General Arrangement Example 2

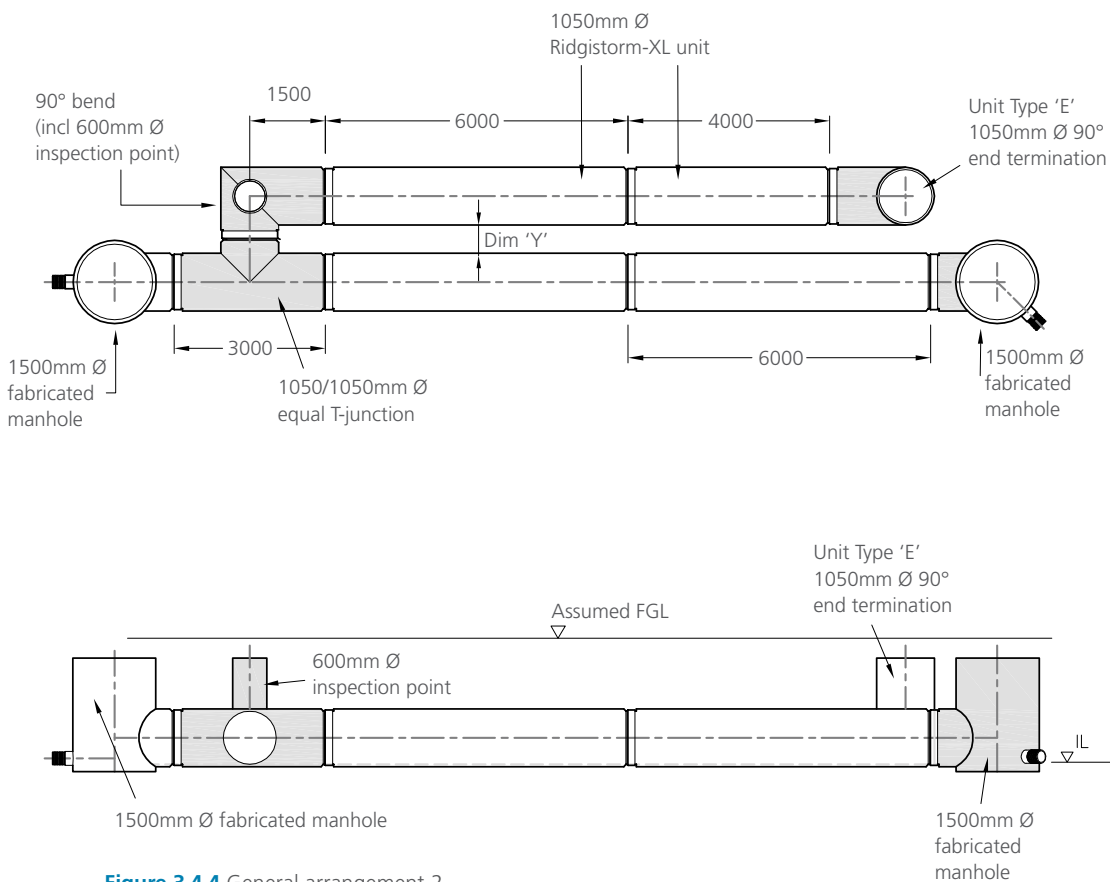


Figure 3.4.4 General arrangement 2

General Arrangements

3.4.5 General Arrangement Example 3

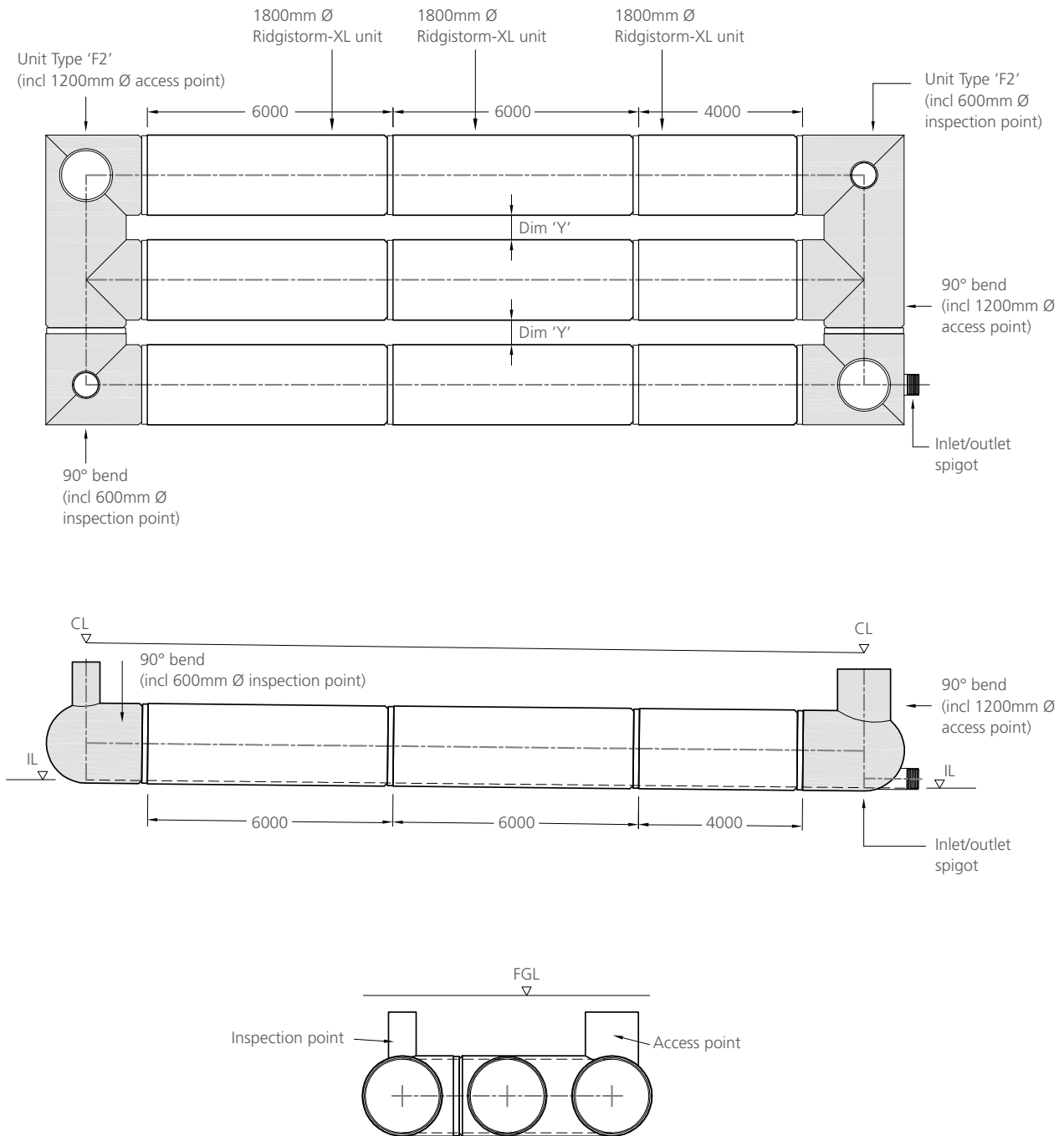


Figure 3.4.5 General arrangement 3

3.4.6 General Arrangement Example 4

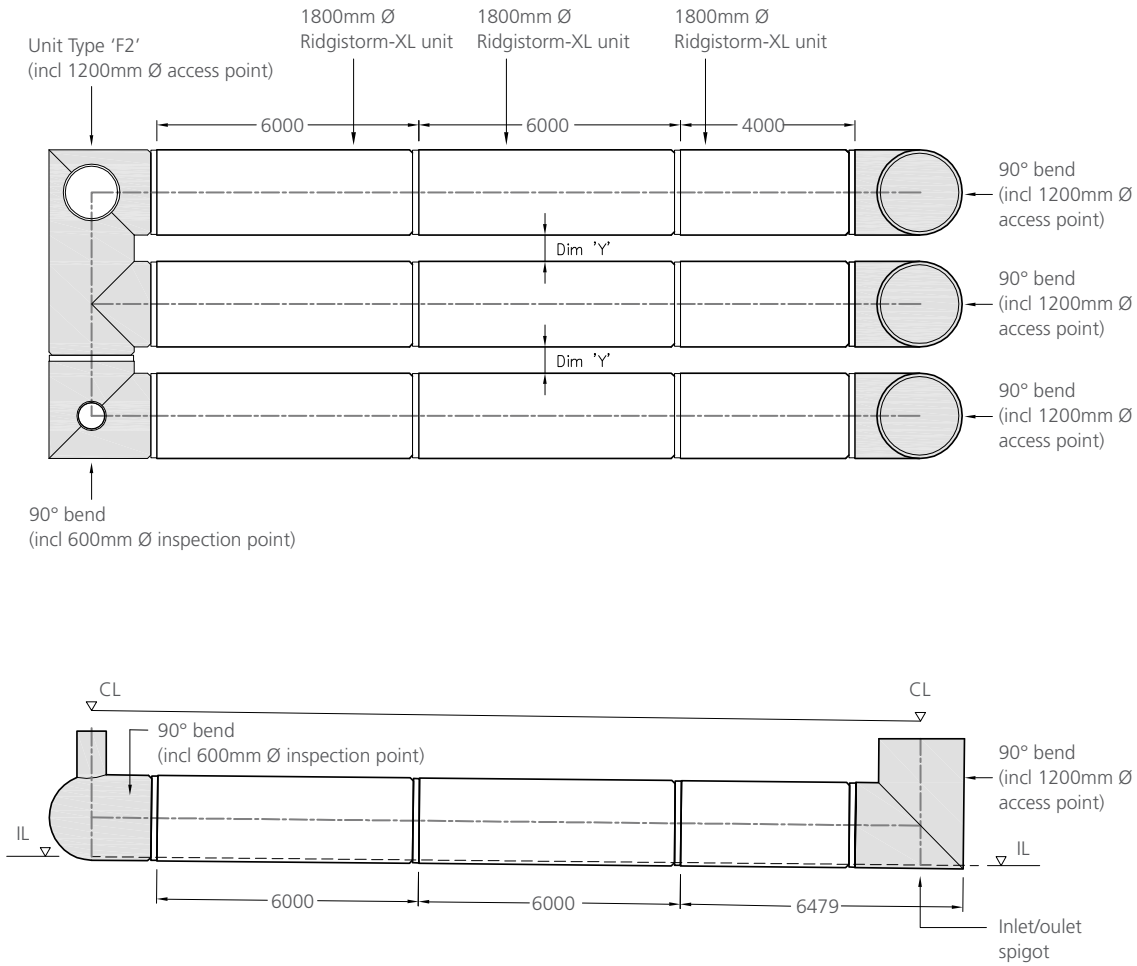


Figure 3.4.6 General arrangement 4

Bespoke Fabrications

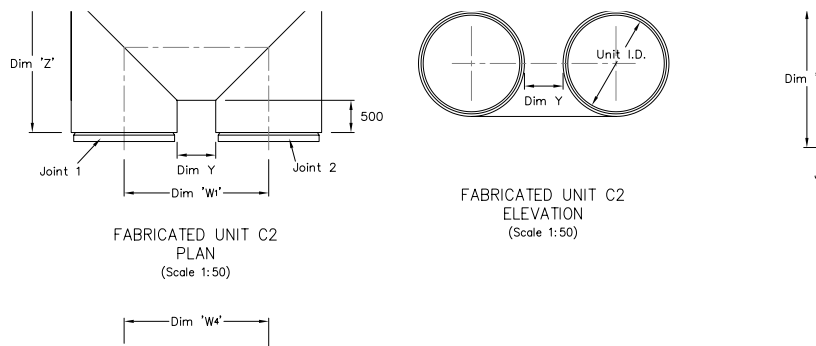
3.5 Bespoke Fabrications

Polypipe WMS has a dedicated, in-house Fabrications Team. Certified and fully trained by The Welders Institute, the department manufactures and fabricates bespoke attachments, bends, fittings and chambers to accompany the range of water management solutions from Polypipe WMS.

Fabricated solutions from Polypipe WMS are designed to integrate into a variety of other applications, including concrete chambers and steel carriage pipes. Reducers and bespoke bends also facilitate the integration of Ridgistorm-XL into existing drainage networks.

We offer a value engineered approach to bespoke fabrications which is supported by our Technical Department who provide sound advice and design experience.

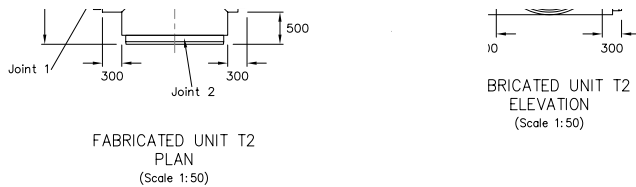
3.5.1 Fittings



Fabricated C unit - Plan

Fabricated C unit - Elevation

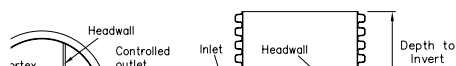
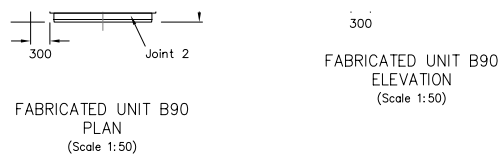
Figure 3.5.1 Fabricated C unit



Fabricated T unit - Plan

Fabricated T unit - Elevation

Figure 3.5.2 Fabricated T unit



Fabricated B unit - Plan

The STORMCHECK is a prefabricated with an integral device.

Fabricated B unit - Elevation

Figure 3.5.3 Fabricated B unit

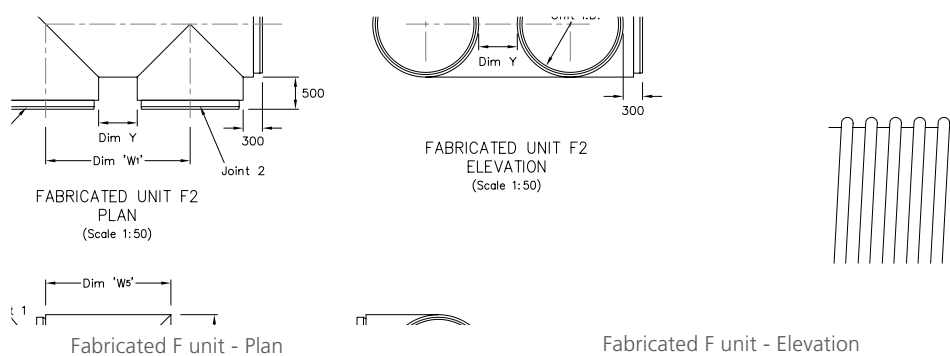


Figure 3.5.4 Fabricated F unit

Ridgistorm-XL Storage Capacities											
Unit Ø (mm)	Min spacing Dim Y (mm)	Unit Dimensions (mm)						Volumes of Fabricated Items			
		W ₁	W ₂	W ₃	W ₄	W ₅	Z				
750	500	1385	2265	2765	1885	1385	1385	1.000	1.594	1.374	0.834
900	500	1540	2580	3050	2040	1540	1540	1.445	2.345	1.994	1.298
1050	500	1715	2930	3430	2215	1715	1715	2.255	3.711	3.278	1.918
1200	500	1820	3140	3640	2320	1820	1820	3.257	5.315	4.681	2.624
1500	750	2395	4040	4540	2645	2145	2145	5.693	9.255	7.892	4.680
1800	750	2705	4660	5160	2955	2455	2455	8.991	15.877	12.932	8.286
2100	750	3050	5355	5855	3300	2800	2800	14.376	23.559	21.827	11.423

NOTE: Based on a pipe ring stiffness classification of 2.0kN/m²

Table 3.5-1 Ridgistorm-XL storage capacities



Manholes

3.5.2 Large Diameter Manholes

Ridgiform-XL pipe can be used in the construction of bespoke large diameter manholes for use in both surface water and foul sewer applications. The Ridgiform-XL range can also be manufactured with integral manhole access to offer a complete pipeline solution with maintenance access.

Bespoke and Off-set Manholes/Catchpits

The flexibility and adaptability of the Ridgiform-XL system, alongside the experience and capability of our in-house Fabrications Team enables us to design and manufacture bespoke manholes to meet site requirements.

Off-set manholes can be integrated into a Ridgiform-XL pipeline or attenuation system to provide easier maintenance access to the system. This utilises a unique step feature within the construction of the manhole to reduce the need for direct access into the pipe with improved health and safety benefits, particularly in foul sewers.

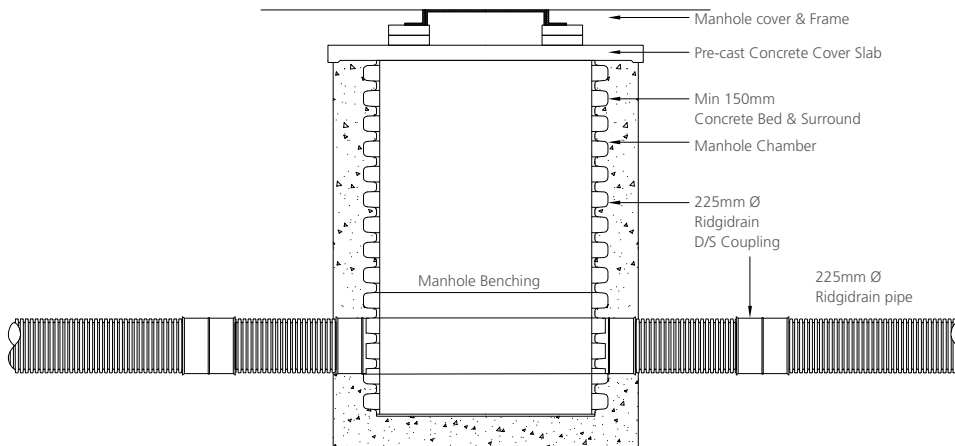


Figure 3.5.5 Typical manhole installation detail

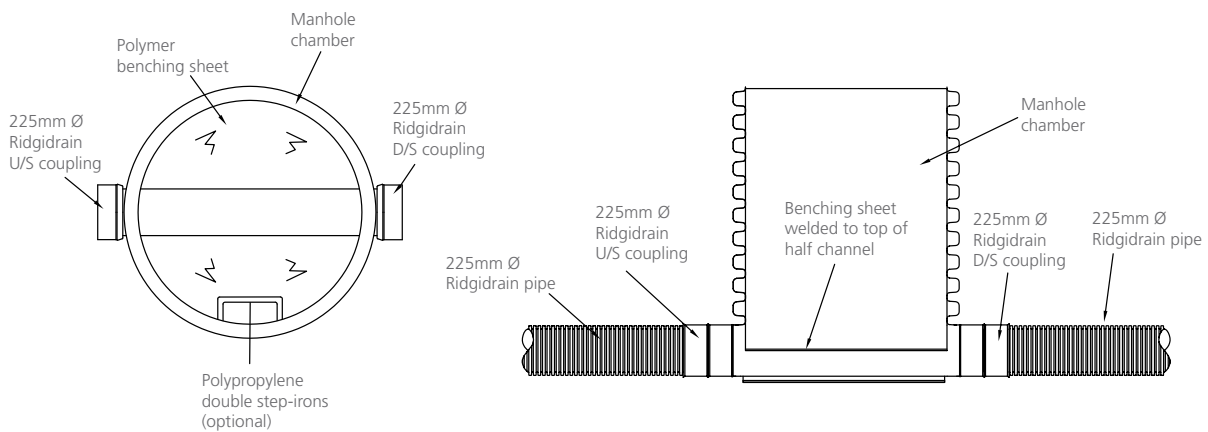


Figure 3.5.6 Typical manhole installation plan

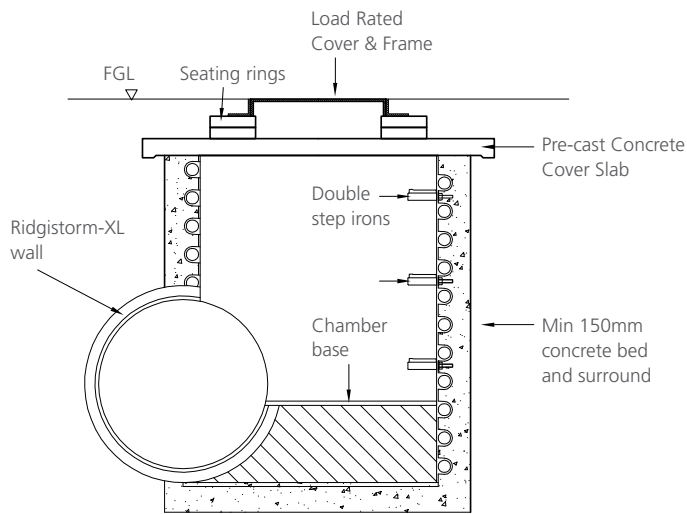


Figure 3.5.7 Typical off-set manhole installation detail

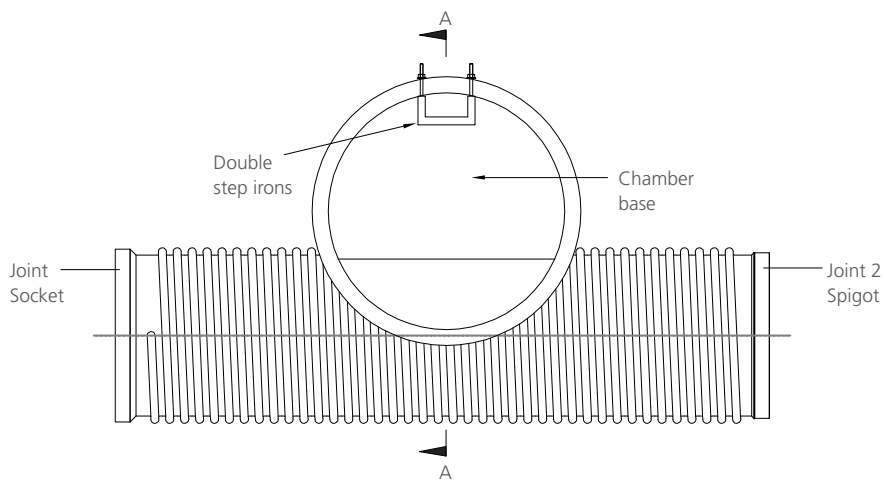


Figure 3.5.8 Typical off-set manhole plan

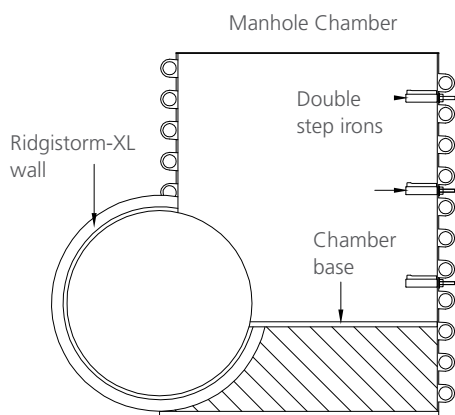


Figure 3.5.9 Typical off-set manhole section A-A

3.5.3 End Termination

In addition to traditional manole chambers, Polypipe are able to offer alternative methods of terminating a Ridgiform-XL pipe run; the following gives a number of examples.

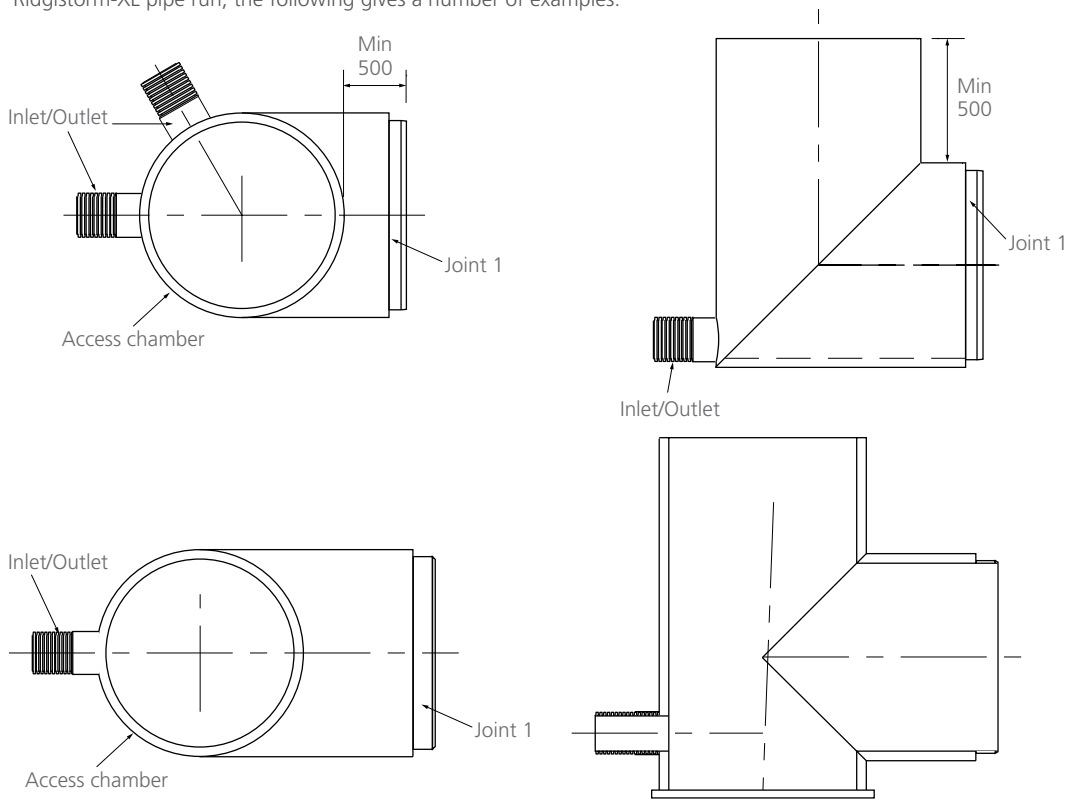


Figure 3.5.10 End Termination

3.5.4 Pipe with Lateral Connection

Lateral pipe connections may be incorporated into standard pipe length.

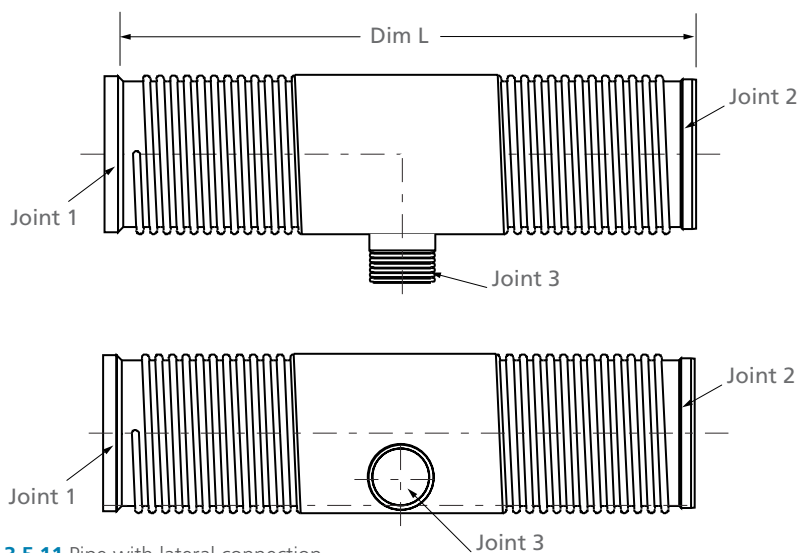


Figure 3.5.11 Pipe with lateral connection

Pipe with Lateral Connection	
Nominal unit diameter (mm)	Lateral pipe diameter available
All unit diameters	150, 225, 300, 400, 500, 600

Table 3.5-2

NOTE: Spigot or socket connection may be offered, depending on specification and diameter of connecting pipe. Contact the Polypipe WMS Technical team for further details on [01509 615100](tel:01509615100).

3.5.5 Access/Inspection Points

Where man access is not required or undesirable Polypipe are able to offer a range of small diameter inspection points incorporated into the Ridgistorm-XL pipe run.

Inspection point

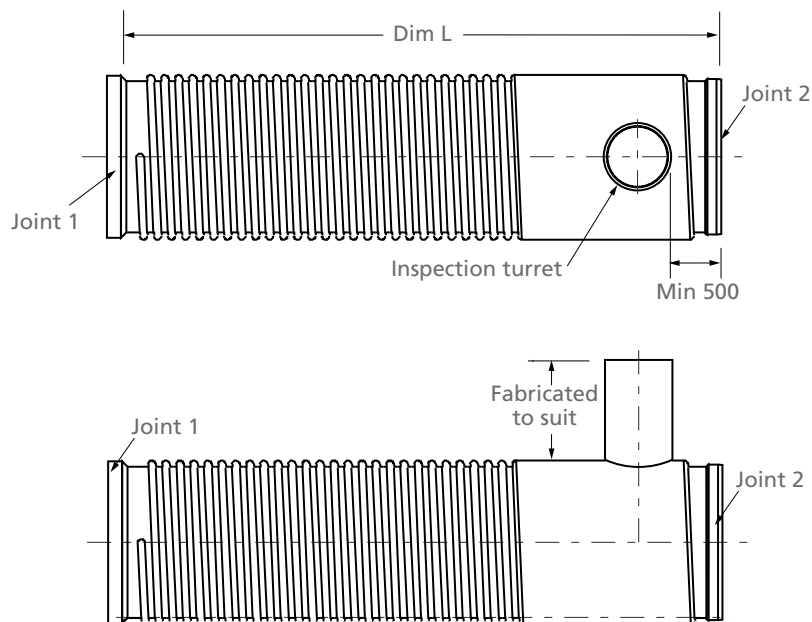


Figure 3.5.12 Inspection point

Inspection Points		
Nominal unit diameter (mm)	Inspection point diameter 450 mm	Inspection point diameter 600 mm
750	✓	X
900	✓	✓
1050	✓	✓
1200	✓	✓
1500	✓	✓
1800	✓	✓
2100	✓	✓

NOTE: Additional inspection point diameters are available on request.

Table 3.5-3 Inspection points

Man Access

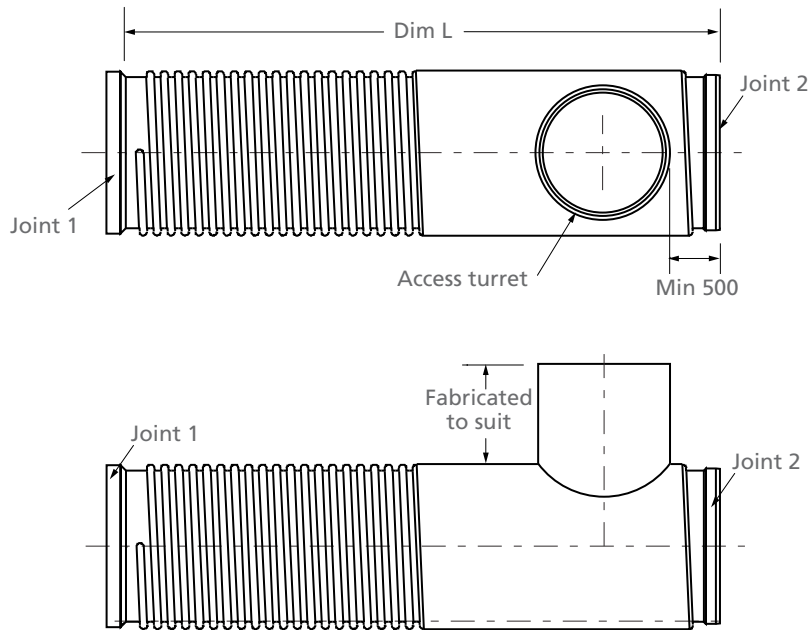


Figure 3.5.13 Man access

Man Access	
Nominal unit diameter (mm)	Man access diameter available (mm)
750	N/A
900	N/A
1050	N/A
1200	1200
1500	1200, 1500
1800	1200, 1500, 1800
2100	1200, 1500, 1800, 2100

NOTE: The access point diameters indicated in the table are for those incorporated into the Ridgiform-XL drainage run. Alternative access arrangements are available.

Table 3.5-4 Man access

Step Iron/Ladder

Polypipe are able to offer chambers incorporating either step irons or access ladders.

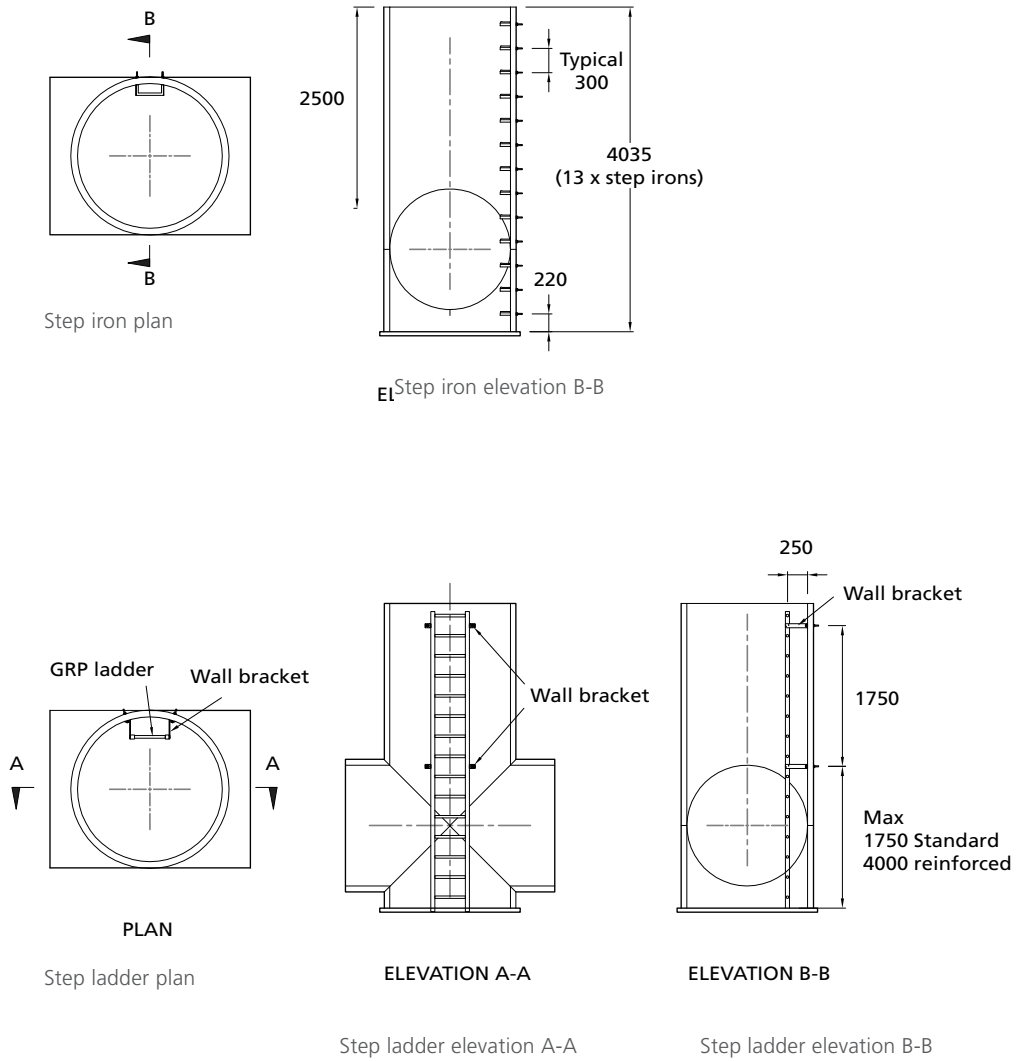


Figure 3.5.14 Step iron/ladder

Hydraulic Design

3.6 Hydraulic Design

Velocities and flow rates for thermoplastic structured wall pipes can be calculated using either the Manning or Colebrook-White equations. The Colebrook-White equation forms the basis of this guide as it has been shown to provide accurate results for a wide range of flow conditions and is the method commonly used in the UK.

$$v = -2\sqrt{(2gSfD)\log_{10} \left[\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{2gSfD}} \right]}$$

Where

- v = Mean water velocity
- g = Gravity
- Sf = Hydraulic gradient (hf/L)
- D = Internal pipe diameter
- ks = Pipe roughness
- v = Kinematic viscosity

An alternative approach is required when utilising the Colebrook-White equation to determine either the pipe diameter or hydraulic gradient variables.

Hydraulic gradient (Sf)

Hydraulic gradient is governed by the pipe slope.

Pipe roughness (ks)

A mean measurement of the height that surface roughness projects from the pipe wall. Measured in terms of an equivalent sand roughness.

Sewer type and age will influence the choice of pipe roughness. Except for calculating initial flow conditions, consideration should also be given to environmental factors, such as sediment and biological slime deposits. Typical values of roughness (ks), for use in the Colebrook-White equation, are given in table 3.6-1.

Selected Roughness Coefficient Values (ks)			
Material	Suitable ks value (mm)		
	Good	Normal	Poor
Clean and new pipes			
Twin wall pipes with coupling joints	0.003	0.006	-
Standard pipes with spigots and socket joints, and O-ring seals at 6 to 9m intervals	-	0.06	-
Slimed sewers			
Flowing half full, velocity approximately 0.7ms ⁻¹	-	0.6	1.5
Flowing half full, velocity approximately 1.2ms ⁻¹	-	0.15	0.3

Table 3.6-1 Selected roughness coefficient values (ks)

However, certain codes of practice, such as Sewers for Adoption 6th Edition (SFA), stipulates a minimum pipe roughness, irrespective of the sewer type.

Where:

- Foul gravity sewer design $k_s = 1.5\text{mm}$ (Clause 2.12 SFA)
- Surface water sewer design $k_s = 0.6\text{mm}$ (Clause 2.13 SFA)

As can be seen from table 3.6-1 these values are very conservative. The very low surface energy inherent with thermoplastic pipes, makes significant biological growth or adhesion of other materials unlikely to occur. A value of 0.009 is recommended for the roughness coefficient when Mannings equation is used.

All charts in this section are based on the Colebrook-White equation.

$$Q = vA$$

Where: Q = Flow rate (m³/s)

- v = Water velocity
- A = Cross-sectional area of pipe bore

Kinematic viscosity (v)

Kinematic viscosity is a ratio of fluids viscosity and density.

Viscosity

Viscosity is independent of pressure and depends on temperature only, therefore, values vary according to the type of fluid and its ambient temperature.

For design purposes $1.141 \times 10^{-6} \text{ m}^2/\text{s}$ may be used (Water at 15°C). The volume of flow may then be calculated using the continuity equation.

Hydraulic Design

Determining the correct pipe size, gradient or discharge capacity using the Colebrook-White equation is an iterative process. Both graphical and tabular methods have been published to assist in the determination of a pipes hydraulic capacity. Typically a chart or table, valid for a particular pipe roughness, details four dependant variables (D, Sf, v & Q). Therefore if any two variables are known, it is possible to determine the remaining two variables.

Extensive work has been carried out in this field by H.R. Wallingford, who have published data in a tabular format. (H. R. Wallingford and D.I.H. Barr; "Tables for the hydraulic design of pipes, sewers and channels"; 7th Edition, Volume 1).

Table 3.6-1, figures 3.7.1 and 3.8.1 are graphical examples, based on typical roughness co-efficients used in structured thermoplastic pipe design.

3.7 Hydraulic Performances

Ridgstorm-XL pipes benefit from a smooth inner wall, providing superior hydraulic performance when compared with rigid materials such as clay or concrete. See fig. 3.7-1 below for details.

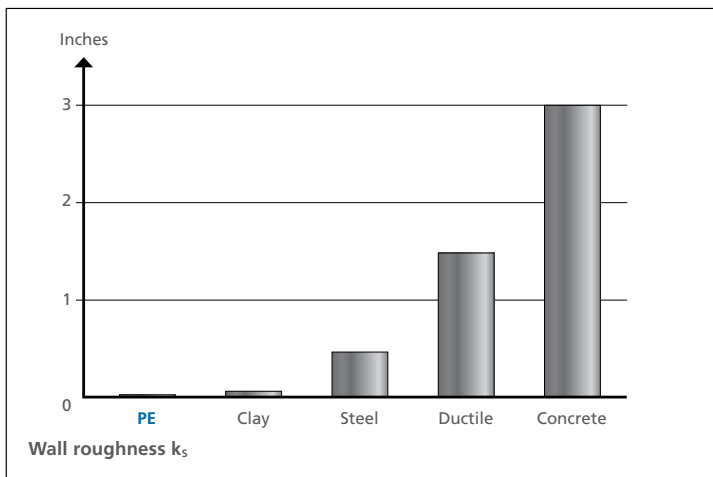


Fig. 3.7.1 Hydraulic performances graph

3.8 Abrasion Resistance

Pipes manufactured from Polyethylene or Polypropylene offer far greater abrasion resistance than alternative materials. The following graph shows the abrasion curve of various pipe materials according to the results of the Darmstadt procedure. This graph demonstrates the superior performance of PE and PP pipes.

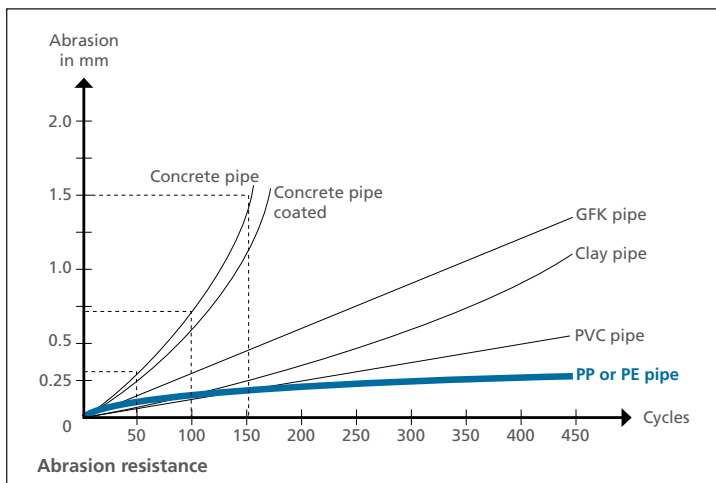
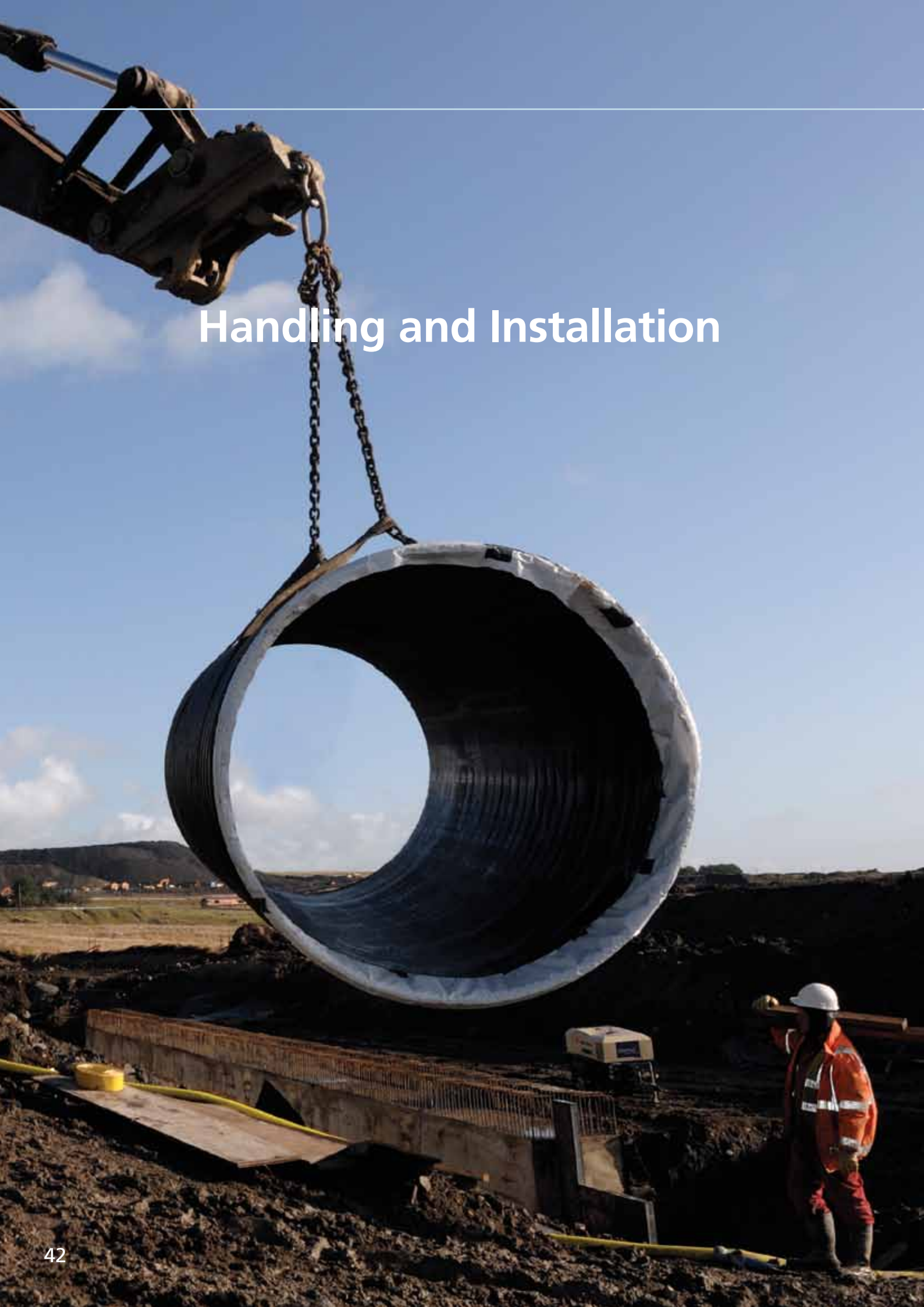


Fig. 3.8.1 Abrasion resistance graph

Handling and Installation



Ridgistorm-XL offers a robust, durable and adaptable solution in comparison to rigid materials such as concrete and steel. Due to its longer lengths and lighter weight, Ridgistorm-XL can be 70% cheaper to transport than equivalent size concrete pipes and can be handled and stored much more safely on-site.



Handling and Installation

4. Handling and Installation

This section covers the transportation, handling and installation of the Ridgistorm-XL system.

Ridgistorm-XL pipes and fittings should be transported, handled and installed in accordance with the requirements of BS5995:Part 6:1980 and, for applicable contracts, the Highways Agency Manual of Contract Documents for Highway Works and Sewers for Adoption.

4.1 Health and Safety

Under the Construction (Design and Management) Regulations 2007, unless they are a domestic client, all parties involved in construction or building work have legal duties.

These include:

Clients

- Check competence and resources of all appointees.
- Ensure there are suitable management arrangements for the project welfare facilities.
- Allow sufficient time and resources for all stages.
- Provide pre-construction information to designers and contractors.

Designers

- Eliminate hazards and reduce risks during design.
- Provide information about remaining risks.

Contractors

- Plan, manage and monitor own work and that of workers.
- Check competence of all their appointees and workers.
- Train own employees.
- Provide information to their workers.
- Comply with the specific requirements in Part 4 of the Regulations.
- Ensure there are adequate welfare facilities for workers.

It should be noted that additional legal duties are imposed where construction work is notifiable.

All installation activities should be carried out observing the requirements of The Health and Safety at Work Etc. Act 1974; and The Management of Health and Safety at Work Regulations 1999.

Ridgistorm-XL Benefits for CDM Compliance

Applications using Ridgistorm-XL Water Management Systems are actually beneficial to CDM compliance. This is because the system avoids or reduces several risks associated with the use of large diameter pipes. Specific advantages of Ridgistorm-XL in this respect are:

- Installation of Ridgistorm-XL is quick – so open excavation time is minimised and high numbers of manpower and machinery is reduced.
- Lightweight in comparison to rigid materials such as concrete and steel, making Ridgistorm-XL easier and safer to handle on-site.

4.1.1 Risk Assessment

Contractors are required to submit a method statement which includes a methodology for installation and risk assessment for the work to be carried out.

Risk assessment examples are available to view on www.polypipewms.co.uk.

4.2 Handling

4.2.1 Transportation and Delivery of Ridgistorm-XL Pipes

When Ridgistorm-XL pipes are delivered to site, the driver must report to the site office and await instructions from the designated individual on-site before any unloading activities can be undertaken.

- The driver will abide by site rules at all times.
- The contractor must be in attendance during off-loading activities and be responsible for self off-load.

Lengths Delivered per Load	
Diameter (mm)	No. of 6m pipe lengths
750	18
900	8
1050	8
1200	8
1500	4
1800	2
2100	2

Table 4.2-1 Number of pipes delivered per vehicle

4.2.2 Moffat Off-load Service

Polypipe WMS are able to deliver Ridgistorm-XL pipes using a flatbed trailer which would be chocked with wood to enable a crane or forklift off-load. Alternatively, Polypipe WMS are able to deliver using a Moffat off-loading service. Where a Moffat off-loading service is utilised, the driver will provide a full off-load service using a Moffat forklift and will transfer the Ridgistorm-XL pipes to the nearest hard standing ground. Hard standing ground is required for both the off-loading and storage of Ridgistorm-XL pipes. Please state your interest in this service at the time of order placement.

4.2.3 Method for Self Off-load and Safe Storage On-site

It is the contractor's responsibility to ensure Health and Safety measures are in place and risk assessments are carried out prior to self off-load and storage on-site. See example risk assessments at www.polypipewms.co.uk.

The following off-loading method is recommended. Mechanical lifting equipment that lifts to a height of 5.2m must be used to unload pipes. Sites must consider working at height regulations when accessing a trailer to place lifting slings.

1. Please carry out an appropriate Health and Safety Risk Assessment for your site.
2. Before preparing to unload check that the load has not moved during transit and that all wedges and banding are securely in place.
3. Load strapping must remain in place until the lifting gear is in place.
4. Loads should be lifted with the use of appropriate nylon slings and carried out by properly certified personnel.
5. Inspect unloaded pipes and deem them to be acceptable and that no damage has occurred. Any pipes that are considered unsatisfactory for installation should be separated from the delivery and a Polypipe WMS agent contacted.
6. When storing Ridgistorm-XL pipes and fittings it is necessary to ensure that they are stored on flat ground, free of stones and other sharp objects to avoid any point loading.
7. If stacking in multiple layers, ensure pipes in higher layers are rotated to 180° to those below so that the sockets of the upper layer are not lying directly over the sockets over the lower layer.
8. Do not stack Ridgistorm-XL pipes more than 2.4m high. Use wood bearing supports between each pipe to ensure even load distribution and chocks to prevent pipes from rolling.

Handling and Installation

4.2.4 Method for Safe Handling On-site

Ridgistorm-XL pipes are robust, lightweight and easy to handle on-site. However please take care to prevent damage, i.e. pipes should not be thrown, dragged or dropped. If pipes are removed by rolling, please ensure they are adequately supported along their length.

When lifting, pipes should be supported at two places along the length. Ideally, protected slings should be used, however, if metal hooks or chains are to be used then padding should be placed between them and the pipes. Movement of pipes on-site should be in a manner not detrimental to the pipes, in any way.

4.3 Installation

4.3.1 Pipe Installation Detail

Unless a site specific installation detail has been assessed at the initial design stage (Refer to section 3.0), Polypipe recommend that the Ridgistorm-XL system be installed in accordance with the following information. Adverse ground conditions may require additional measures to maintain pipe support (i.e. reinforcement of the trench base through soil improvement techniques or the use of geosynthetic reinforcement).

Please note that adopting or approving authorities may have specific installation requirements; the installer should therefore verify that the following installation method would be acceptable before construction activities commence.

4.3.2 Trench Preparation

Trenches should not be excavated too far in advance of pipe installation and should have adequate support to comply with health and safety requirements. Trenches should be as narrow as practicable, while still maintaining sufficient space for the operation of appropriate compaction equipment, or access for site personal (i.e. if required during electro-fusion jointing). The trench width will typically correspond to the pipe outer diameter, plus an additional 150 – 750mm either side of the pipe; the exact dimension dictated by pipe diameter and assumed installation conditions. Where multiple pipes are installed in a trench, sufficient space should be allowed between adjacent pipes to ensure that material can be placed and compacted.

The trench base should be assessed to ensure it has sufficient bearing capacity and meets the required level/gradient. Any soft spots should be excavated and filled with a suitable compacted granular material.

Water should not be allowed to accumulate in the trench.

Adequate provision should be made for the removal of groundwater, to a consented disposal point, before and during installation.

4.3.3 Pipe Bedding

The bedding material is laid below the pipe to provide uniform support and to permit small adjustments of the pipe's line and level. In cases where the 'as dug' material is suitable as pipe surround, imported bedding is not required and the trench bottom should be loosened. Otherwise a minimum 150mm bedding depth of granular material should be placed and compacted in the trench bottom. If required, depressions should be formed within the bedding material to accommodate pipe sockets or couplers.

Bricks, stones, blocks of wood or other similar objects should not be placed below the pipe, to facilitate adjustment of line and level; as this may cause high local stress concentrations and pipe deformations (i.e. objects temporarily placed beneath a pipe while bedding is added or rearranged, will rapidly become covered, difficult to locate and easily forgotten).

Pipes should be jointed in accordance with Polypipe WMS recommendations, (Refer to section 4.5).

Air testing is recommended prior to placement of the sidefill and backfilling to ensure correct workmanship, (Refer to section 4.6).

4.3.4 Sidefill Placement

Once a pipe section has been laid and successfully tested in accordance with BS EN 1610, any depressions formed in the bedding material to accommodate sockets or couplers should be reinstated, ensuring that no voids are left around the joint. Pipe surround material should be evenly placed across the width of the trench in 150 - 300mm layers**, in accordance with the design and specification. A 95% degree of compaction should be achieved unless otherwise specified within the structural assessment. Material should be placed in such a manner as not to dislodge, distort or damage the pipe. Care should be taken to ensure that fill material is placed and compacted beneath the haunch of the pipe before placement and compaction of the remaining surround material. Compaction plant should not be permitted to contact the pipe. Trench supports should be progressively removed during placement of the sidefill material, thereby allowing sidefill to be compacted against the native soil. Where this is impractical, it should be noted at the initial design stage.

** Required compaction levels may be achieved through an appropriate method of work, related to:

- Fill material specification.
- Thickness of placed layer.
- Compaction plant being used alternatively, if required, compaction may be verified by in-situ tests.

4.3.5 Backfill Placement

Material should be placed and compacted a minimum 150mm above the pipe crown; compaction plant should not be used directly above the pipe until sufficient layers of backfill material has been placed. Backfilling of the trench should be undertaken after the successful completion of the previous operations. Unless otherwise described in the specification; Class 1, 2 or 3 fill material in accordance with SHW Series 600 may be placed and compacted in layers not greater than 300mm thick. No stone or soil particle exceeding 40mm in diameter should be used within 300mm of the pipe crown (i.e. Class 8 fill material in accordance with SHW series 600).

4.4 Typical Installation Details

4.4.1 Minimum Cover Depths

Polypipe WMS recommends the following minimum depths of cover:

- 1.2 m from the crown of the pipe to the surface under roads subject to Highways Agency requirements.
- 0.9 m from the crown of the pipe to the surface under roads not subject to Highways Agency requirements.
- 0.6 m under field loading conditions.

Reduced covers depths may be allowable, subject to specific design. It should be noted however, that the relevant adopting Authority may have specific installation requirements. For Example Sewers for Adoption 6th Edition stipulates that sewers laid within a highway maintain a minimum depth of cover of 1.2m and a depth of 0.9m in all other areas.

Handling and Installation

4.4.2 Maximum Burial Depths

The flexibility of the Ridgistorm-XL system is such that pipes are designed to match the exact site conditions.

The performance of Ridgistorm-XL pipe is influenced by:

- Native ground properties (i.e. stiffness of the soil in which the trench is cut).
- Imposed dead load (i.e. depth and density of the overburden).
- Imposed live load (i.e. loads due to vehicle trafficking).
- Hydrostatic loads.
- Pipe bedding detail.
- Specified allowable maximum limit of deflection.

4.4.3 Typical Installation Detail (applicable for drainage and attenuation)

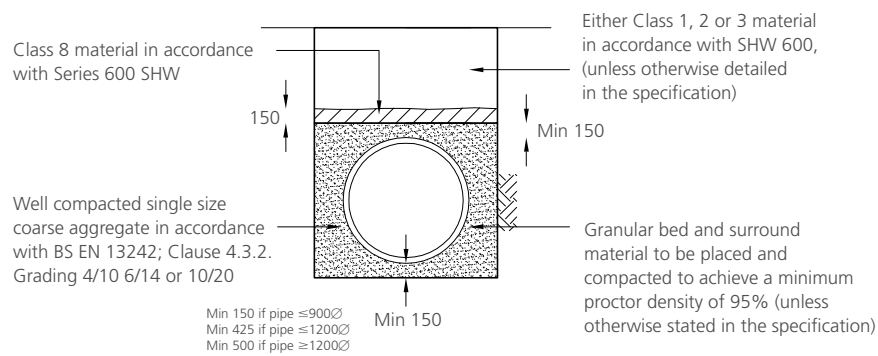


Figure 4.4.1 Standard Ridgistorm-XL trench with single pipe installation - detail 1

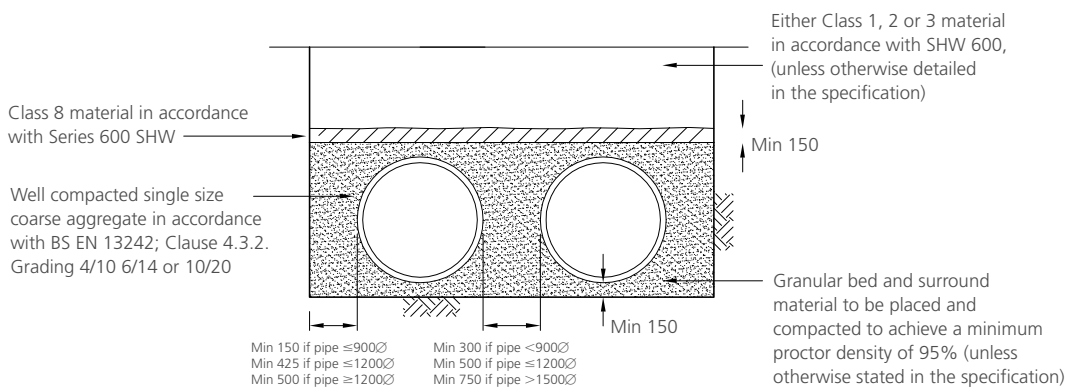


Figure 4.4.2 Standard Ridgistorm-XL installation - detail 2

When installed with a granular bed and surround, Ridgiform-XL pipes require a minimum depth of cover to be maintained above the pipe crown, section 4.4.1. Where these cover levels cannot be achieved, protective measures such as detail 3 (reinforced concrete slab) and 4 (concrete bed and surround) should be used. The Consulting Engineer and approving authority should be consulted when determining the most appropriate method.

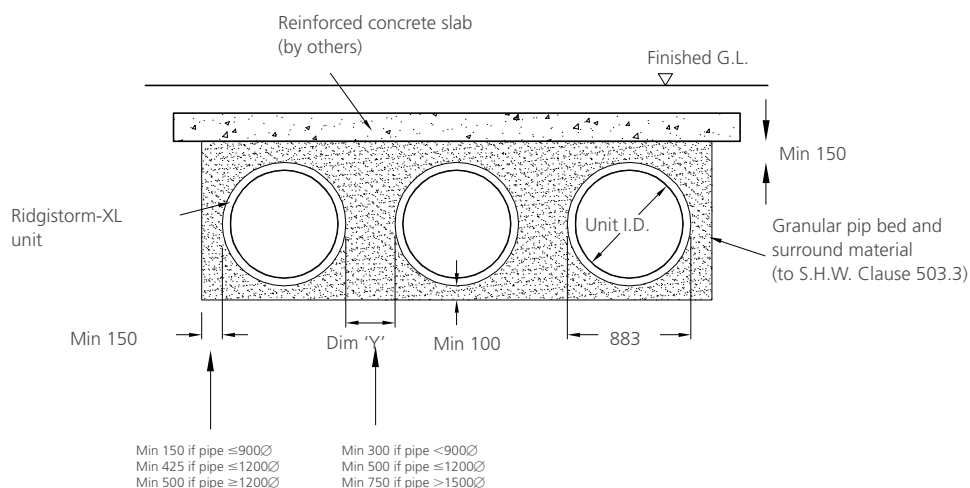


Figure 4.4.3 Ridgiform-XL installation - detail 3

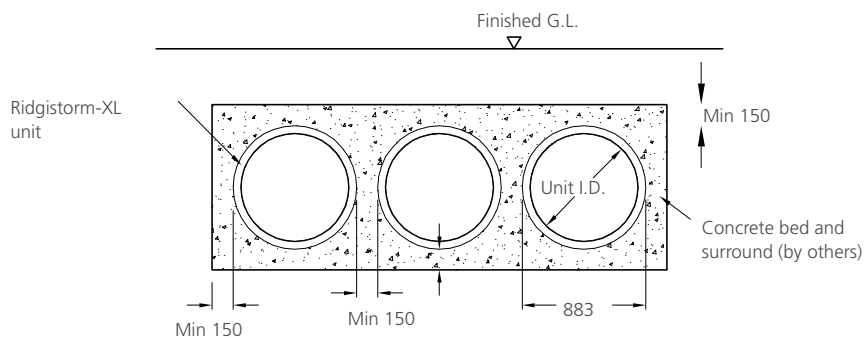


Figure 4.4.4 Ridgiform-XL installation - detail 4

Electro-fusion Jointing

4.5 Unique, Patented Electro-fusion Joint

Polypipe WMS offers the only large diameter plastic pipe solution with integral electro-fusion jointing. Electro-fusion wire is connected to the socket end of the pipe during manufacture and supplied with a unique barcode containing the settings and installation parameters for the pipe.

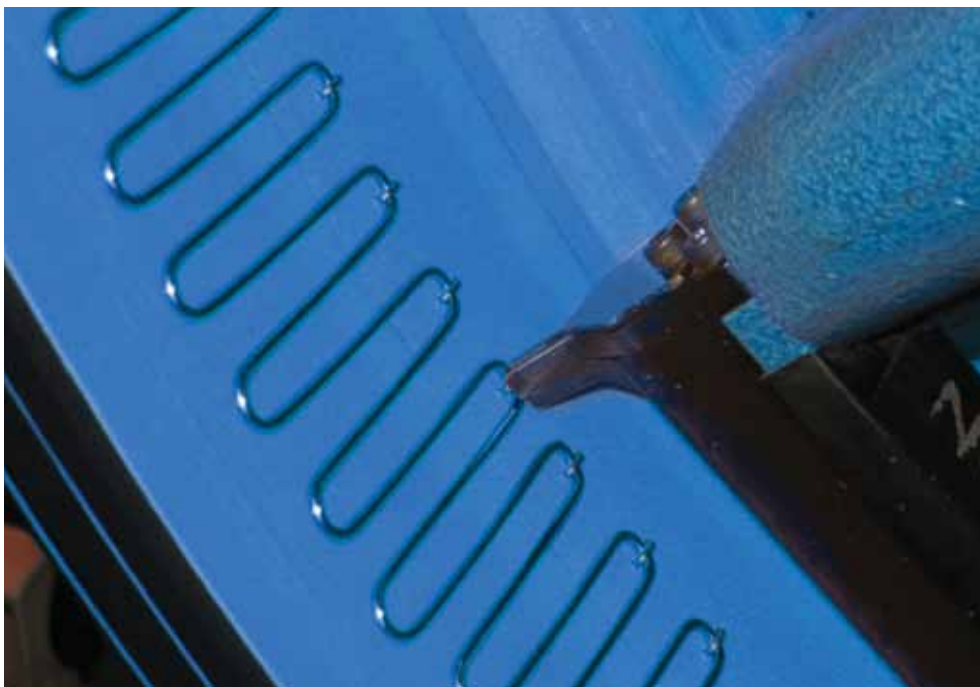
Once the two connecting pipes have been brought together, internal and external support rings are applied to apply pressure to the seal during the jointing process.

The electro-fusion wire is then connected to an electrical supply which joins the pipes together. Using the electro-fusion jointing method, 100% seal tightness can be achieved to guarantee exceptional joint and pipe performance.

In comparison with other large diameter systems, Ridgistorm-XL can be handled, jointed and installed much quicker, resulting in time and cost savings on-site.

Health & Safety Benefits

Electro-fusion jointing offers improved health and safety benefits over traditional jointing methods reducing the need to work within confined spaces. On-site, Ridgistorm-XL can also be jointed at the side of the trench before being craned into position, reducing health and safety risks during installation and speeding up installation.



The following four pages outline and explain the electro-fusion jointing process in easy to follow steps

4.5.1 Equipment Requirements (depending on site conditions)

- 415v 3 Phase generator with (preferably 15kva) output or mains power*.
- Polypipe Electro-Fusion Control Unit*
(please note that the system does not work with a standard UK ECU).
- Polypipe transformer*.
- Alcohol cleaning fluid (99.9% alcohol).
- Dry, lint free cleaning cloths.
- An internal support ring (for sizes 900mm and above).
- An appropriately sized outer tension clamp.
- 5mm Allen key.
- Wrecking bar/steel bar for tightening internal supporting ring.
- Outer Tension Clamp tightening device.
- Welding adapter*.
- Suitable lifting/manoeuvring plant/straps.
- Waterproof marking pen.
- Hammer.
- Means of communication between all operatives.
- Dewatering equipment (if ground water present).

Note: *Two will be required for 1500mm and above pipe sizes if jointing simultaneously.

4.5.2 Preferable

- Clean, dry baseboards or groundsheets.
- Welding shelter.
- Torch.

4.5.3 Pre-joint Checks

- All equipment to be clean, in good condition, regularly maintained and within calibration or service dates.
- Check that the inner and outer tension clamps are in good condition.
- Ensure that the generator has sufficient fuel for the duration of the electro-fusion process.
- Do not start the process unless it can be completed in one go.

Electro-fusion Jointing

4.5.4 Do

- Understand the electro-fusion process.
- Ensure that the operatives are familiar with the equipment to be used.
- Always use the outer tension clamping band.
- Use the internal supporting ring for sizes 900mm and above.
- Observe correct fusion and cooling times.
- Allow all of the alcohol cleaning fluid to evaporate before assembling the joint.
- Providing that the correct lifting equipment is available, consider fusing the joints out of the trench and lower the pipe into place later.
- Protect the welding area against dirt, humidity and direct sunlight. It is good practice to use a welding shelter at all times. It is essential to use a shelter in damp or wet conditions.
- Use a baseboard or groundsheet to protect against dirt and damp.
- If ambient temperature falls below 10 degrees use one or more pre-heat cycles (see table 4.5-1 below).
- Risk assessments and working in confined space regulations should be adhered to (see example risk assessment at www.polypipewms.co.uk).
- Once the first pipe is in position, support of the pipe can be achieved by completing the pipe bed surround. This can be done for all upstream pipes once the jointing process for each pipe is complete.
- Check line and levels of the installation at regular intervals.
- Protect the pipe from damage when using force to push the pipes together.
- If the pipes do not go together easily, place a band around the spigot, heat the area and tighten.
- If air test fails repeat electro-fusion process. (If air test fails after completing electro-fusion process twice, contact a Polypipe WMS agent).

4.5.5 Do Not

- Do not start any electro-fusion joint if it cannot be completed without interruption.
- Do not position the ECU in the trench or use it in potentially gaseous atmospheres.
- Do not use dirty or contaminated fittings.
- Do not touch prepared surfaces.
- Do not prepare fittings until immediately before they are to be used.
- Do not allow the jointing area to become wet or damp (consideration should be made for ground water).
- Do not backfill the joint until it is determined satisfactory.
- Do not carry out electro-fusion jointing if ambient temperature is below 5°C.

Welding Preheat Intervals		
DN (mm)	Welding Voltage	Preheat Interval Sec.
750	28	400
900	39	400
1050	40	400
1200	43	450
1500	32	500
1800	40	500
2100	40	600

Table 4.5-1 Electro-fusion welding parameters for preheating

4.5.6 Jointing

- With the pipe still suspended just above the trench bed, locate the outer tension clamp into the groove around the socket end of the pipe to be welded and tighten one of the Allen bolts on the clamp bracket, just enough to hold it in place. Make sure that the clamp bracket is approximately 250mm from the element wires with the free end facing away.
- Orient the pipe in the trench so that the ends of the fusion element are in a convenient place to weld. For pipes up to 1200mm there is one continuous element and it is likely that the best orientation will be with the element ends in the '12 o'clock' position. For pipes of 1500mm and above, there are two elements with the ends diametrically opposed. The likely best orientation for these pipes will be at the '3 o'clock/9 o'clock' position. Once orientation has been decided upon ensure that all subsequent pipes in the string are all oriented the same way. This will help to reduce any issues associated with pipe ovality.
- Using a suitable baseboard or groundsheet, move the pipe ends within a few feet of each other. Consider putting a board or groundsheet under the opposite end of the pipe too, to simplify the next joint.
- For sizes 900mm and above (not required for 750mm pipe) position the inner tension ring inside the mouth of the spigot, about 20mm from the end of the pipe and tighten by hand until it just 'nips' into place. Do not tighten yet. Remove the protective wrapping and inspect the pipe ends for damage.
- Using separate clean and lint free cloths, clean the socket and spigot of the two pipes to be jointed (see pic 1). Measure the insert depth of the socket and mark this at intervals around the spigot with a waterproof pen. Ensure that all of the alcohol evaporates from the pipe ends. Do not touch the prepared surfaces or allow them to become dirty or wet.
- Ensure that the fusion element ends do not touch each other and bend them over the outside of the spigot, facing away from the joint. This ensures that they do not become snagged whilst assembling the joint.
- Push the spigot end into the socket (see pic 2), ensuring that the wire ends are not displaced. If using mechanical assistance ensure that the pipe end being pushed is suitably protected. Push the joint 'home' until the previously made pen marks 'meet' the socket. Ensure that both pipes are straight and true, with no bending. It may help to 'rock' the pipes whilst mechanical pressure is applied. If rolling of the pipe is possible use chocks to prevent it doing so.
- Enter the pipe from the open end and move to the jointing area. Ensure that the previously inserted inner support ring is approximately 20mm from the joint and fully tighten using a wrecking bar or steel bar (see pic 3).
- 'Back off' tightening tool. Slacken the Allen bolt on the external tightening band and fit the tightening tool (see pic 4). This is done by slipping the free end of the band into the 'nose' of the tool and also into the centre jaw section. Slide the tool along the free banding end until the nose pushes against the clamp bracket. Push the tool against the pipe so that the short clamping lever is pressed against the pipe which causes it to 'nip' the tightening band. Alternatively, hold the clamping lever with one hand and tighten with the other. Tighten the tool (see pic 5). Once it has gripped the band, the clamping lever can be released and the tool can be angled away from the pipe slightly to facilitate tightening.



Pic. 1



Pic. 2



Pic. 3

Electro-fusion Jointing Process



Pic. 4



Pic. 5



Pic. 6



Pic. 7



Pic. 8

- Finally, tighten the Allen keys to avoid slipping. If a fitting or short length of pipe is being welded restrain it so that there is no possibility of moving during the welding process. On pipes 1500mm and above, the two welds can be done consecutively or simultaneously if two Electro-Fusion Control Units (ECU's) are available.
- Trim the wire element ends to approx 80mm/3" and connect the adaptor block. Connect the terminals of the (ECU) to the adaptor ([see pic 6](#)). The terminals can be fitted either way. Ensure that the weight of the leads does not twist or bend the wire element ends towards each other, causing a short-circuit. Position the ECU out of the trench and away from gaseous atmosphere.
- Plug the ECU into the transformer and the transformer into the generator or other 415v three phase supply. Start the generator, allow to stabilise and turn on the ECU. The generator should be positioned so that exhaust fumes do not enter the trench.
- Enter the welding or preheating**parameters into the ECU by scanning the label on the joint with the barcode wand ([see pic 7](#)). Pass the wand over the barcode on the sticker on the pipe end quite briskly. The machine will beep, please note that tones may vary. If a reading cannot be made use the appropriate barcode on the supplied sheet or enter the details manually (see separate instructions). Ensure that the reader wand is replaced in its sheath for protection.
Note:**Continue with the weld immediately after preheating.
- Check that the screen shows the correct welding parameters and if so, press the green button to accept ([see pic 8](#)).
- The ECU asks if the pipe has been scraped. Press the green button for 'yes' (Scraping is not necessary as contamination is removed during the cleaning process). Welding will now start. Do not allow the pipes or equipment to move during the fusion process.
- At a point approximately 75% into the welding time, retighten the outer tension band.
- When the fusion time has finished the ECU will beep. Wait for 10 minutes before the terminal ends are removed or disturbed. Allow the joint to cool for another 30 minutes before removing the clamps. DO NOT assemble the next joint whilst the previous joint cools. It MUST remain undisturbed. If site conditions allow and there are enough outer and inner rings available then it may be possible to save time by assembling several joints in one string and then weld consecutively.

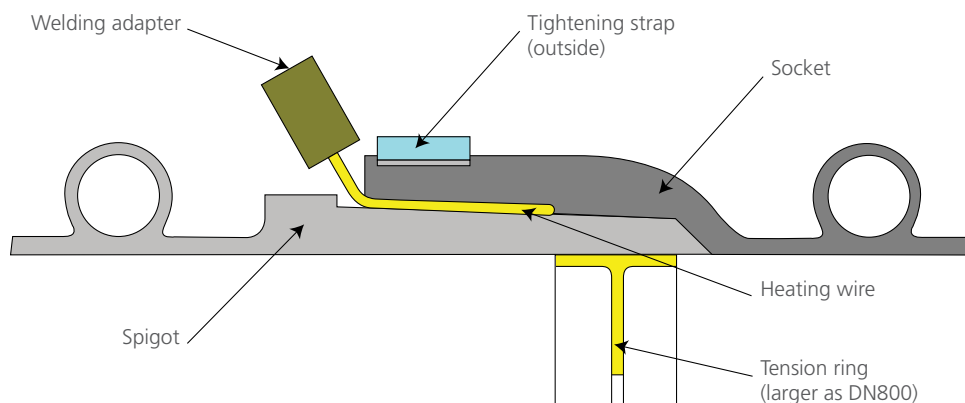


Fig. 4.5.2 Diagram showing the position of tools during electro-fusion process

Welding Parameter for Electro-fusion Socket				
Diameter	Voltage	Time in secs. at one element	Voltage	Time in sec. at two elements
DN750	28 volt	1020 secs	-	-
DN900	39 volt	720 secs	-	-
DN1050	40 volt	1200 secs	-	-
DN1200	43 volt	1260 secs	-	-
DN1500	-	-	32 volt	1020 secs
DN1800	-	-	40 volt	900 secs
DN2100	-	-	40 volt	1230 secs

Please note: Times stated above are approximate only. Visible sign of welding completion is the melting plastic protruding from the socket towards the welding wire (see Fig. 4.5.4).

Table 4.5-3 Welding parameters for electro-fusion socket



Fig. 4.5.4 Visible sign of welding completion

Testing

4.6 Recommendations on Pressure Testing

If required, structured walled thermoplastic pipes may be tested using a conventional air test in accordance with BS EN 1610.

4.6.1 Air Test Method

1. Block the ends of the pipe, including any branches, using sealed, expanding stoppers/inflatable bungs.
 2. Fill a U-tube manometer with water to the correct level, ensuring that there are no trapped air bubbles in the water.
 3. Connect the manometer to the appropriate port of one of the stoppers.
 4. Increase the pressure in the pipe until a pressure of 100mm of water (0.01 Bar) is reached.
 5. Allow the pressure to stabilise for several minutes, increasing the pressure to 100mm head of water if it drops.
 6. Record any change in pressure over a 5 minute period. Without further pumping it should not drop below 75mm head of water. Air test problems are generally due to faulty equipment or test procedures and the following advice may be of assistance.
- Always install pipes in accordance with Polypipe WMS recommendations and the applicable specification.
 - Check that the test equipment does not leak and is in proper working order by testing a short length of pipe submerged in a water bath.
 - Ensure that the test stoppers, tubes and pump are in good condition and that all seals are correctly fitted.
 - Ensure that the pipe bores are free from dirt and debris that could affect sealing of the test bungs.
 - Ensure that the test stoppers are placed tightly, squarely and in the pipe barrel, not the fittings.
 - Ensure that all openings are properly sealed, including those to be buried underground, prior to testing and backfilling (e.g. gulley and lateral pipe connections).
 - Although convenient, the air test is more sensitive than water tests and failure is not conclusive. The air test is very sensitive to temperature changes and must not be performed unless the pipe temperature is stable.
 - Failures due to testing immediately after backfilling a pipe that has previously been heated in the sun are common. A 1°C temperature change in the air inside the pipe will result in a pressure change sufficient for the test to fail.

Maintenance

4.7 Maintenance

Structured walled thermoplastic pipe systems do not require routine maintenance. However, where the design flows through a pipe system is insufficient, long term deposition of silt and/or solids may occur. Maintenance is therefore normally limited to de-silting/solids removal.

4.7.1 Access

Access to the system should be provided by conventional means such as manholes, catchpits, inspection chambers or rodding points.

4.7.2 Water Jetting

It is recommended that water jetting operations follows the procedures laid out within Sewer Jetting Code of Practice, 2nd Edition (WRC, 2005). Observing all other relevant pieces of legislation and recognised codes of practice.

There are two principle types of jetting unit

- Low pressure, high volume.

Low pressure, high volume units are typically lorry mounted, with a large water carrying capacity and a facility for vacuum extraction of debris.

- High pressure, low volume.

High pressure, low volume units are typically small trailer mounted units with a minimal water carrying capacity and generally do not have a facility for removing material from the system being cleaned.

Polypipe Civils always recommends the use of low pressure, high volume units when jetting plastic pipes.

The appropriate unit type is largely dependant on the pipe diameter and whether jetting is being used for blockage removal or cleaning. Cleaning generally requires higher flow rates to ensure finer deposits are re-entrained into the sewage or surface water flow and transported downstream. Larger and heavier material is kept in motion through the power of the jets, progressively rolling the deposits down the pipeline. Typically, for the same power output, an increase in flow rate can be more effective than increasing the pressure when removing debris.

4.7.3 Maximum Recommended Pressures

The ability of a drain or sewer to withstand jetting without damage depends on its structural condition. The maximum recommended pressure for plastic sewers and drains, in good structural condition, is 180 bar (2600 psi).

However, material does not readily bond to polymer pipes due to their smooth non-porous bore and low surface energy. Research has shown that debris can be easily removed from plastic pipes at pressures below 1500 psi.

It should be noted that where details of the sewer material or structural condition is unavailable and there is no evidence to suggest the pipe is in a good condition, it is recommended that a maximum pump pressure of 130 bar (1900 psi) is used [Except in areas where brick masonry or pitch fibre sewers may be present a maximum 100 bar (1500 psi) is recommend].

Recommended maximum jetting pressures may be as low as 80 bar (1200 psi) for pipes in extremely poor structural condition.

General Properties



Ridgistorm-XL pipes are manufactured from high density polyethylene and are robust, durable and adaptable.

General Properties

5. General Properties

5.1 UV Light Resistance

Ridgiform-XL pipes are resistant to UV attack and can be safely stored on-site without any damage or aging effects for a maximum of 6 months.

5.2 Chemical Resistance

All of the materials used in Polypipe's thermoplastic structured wall pipe systems have excellent chemical resistance characteristics, especially when compared with traditional materials such as concrete. For example, sulphates and sulphuric acid (non fuming) have no measurable effect on polyethylene and polypropylene yet are severely detrimental to ordinary concrete. However, under rare conditions, there are substances that can have an effect on plastic and rubber materials and detailed chemical resistance information is available in the following standards:

Chemical Resistance	
CP312:Part 1:1973	Code of practice for plastics pipework (thermoplastics material) General principles and choice of material
BS ISO 4433-2:1997	Thermoplastics pipes - Resistance to liquid chemicals Classification Part 2: Polyolefin pipes
BS ISO 4433-3:1997	Thermoplastics pipes - Resistance to liquid chemicals Classification Part 3: PVCu
ISO/TR 10358:1993	Plastic pipes and fittings - Combined chemical resistance classification table
ISO/TR 7620:2005	Rubber materials - Chemical resistance

Table 5.2-1 Chemical resistance

A number of statements can be made on the chemical resistance of Polypipe's thermoplastic structured wall pipe system. Under typical installation conditions the system is:

- Unaffected by pH in the range of 0.1 – 14.
- Unaffected by inorganic salts in any concentrations, including heavy metals.
- Unaffected by dilute aqueous solutions of organic chemicals such as detergents.
- Unaffected by low concentrations of hydrocarbons and oils in normal use, such as run-off from roads and car parks. Where hydrocarbons are present in higher quantities, for example a garage forecourt, nitrile seals should be specified in place of the standard EPDM seals upstream of the separator.
- Unaffected by any naturally occurring compound in soils, including humic and fulvic acids found in peaty soils.
- Unaffected by sulphates in any concentration and sulphuric acid (non-fuming).

- Affected only by a limited number of industrial chemicals that are only rarely found in the environment in sufficient concentration to be detrimental to Polypipe's thermoplastic structured wall pipe systems. This may only occur in heavily contaminated industrial sites where concentrations may be high enough to warrant further investigation. Disposal of industrial chemicals into drains should not occur due to environmental regulations. Spillages should be contained and result in short-term exposure and it should be noted that any effects may be reversible and are dependent on concentration, frequency and duration of exposure. The current world-wide inventory of industrial chemicals extends to many millions of compounds and no definitive list detailing their effect on polymers exists. For further information or detailed advice contact our Technical Team on **01509 615100**. The following information is required in order to evaluate fully the suitability of Polypipe's thermoplastic structured wall pipe products for any given application:
 - The chemical(s).
 - The concentration of the chemical(s).
 - The frequency and duration of exposure.
 - The maximum temperature of the chemical(s).
 - The design life of the pipe system.

Where pipes are placed in contact with contaminated ground, specific assessment should be undertaken, although it is rare for contaminants to be present at concentrations that will damage the pipes.

5.3 Durability

When making an assessment of the durability of large diameter pipes and fittings it is important to take three factors into account. The first is structural integrity i.e. is the pipe strong enough to withstand short term installation practices. The second is long term deformation or creep and the final consideration should be to any chemical effects or ageing.

Ridgiform-XL is manufactured from highly durable PE or PP materials which have been formulated and tested to ensure that the materials used have appropriate short and long term mechanical strength and are chemically resistant to the effects of long term aging or oxidation. The short term structural integrity of the pipes are determined by detailed structural design and analysis and is checked by compression testing in accordance with BS EN ISO 9969 Thermoplastic Pipes; Determination of Ring Stiffness and BS EN 1446 Plastics Piping; Determination of Ring Flexibility and Ducting Systems. The long term deformation resistance of Ridgiform-XL is checked by determining the creep ratio of the pipe and material in accordance with BS EN ISO 9967 Thermoplastic Pipes.

When all of these factors are taken into account and provided Ridgiform-XL is installed in accordance with our installation instructions it is safe to assume that there should be no deterioration of the system before 100 years of life.

Project Solutions



We have considerable project experience in sustainable drainage projects, providing tailor made solutions for our customers' requirements.

Case Studies

6.1 River Diversion Project using Ridgistorm-XL

Polypipe WMS completed a challenging river diversion project at the Ffos-y-Fran Land Reclamation Scheme in Merthyr Tydfil, Wales using its Ridgistorm-XL large diameter pipe system. Working alongside the main contractor, Dawnus Construction and project engineers Peter Brett Associates, Polypipe WMS has supplied and installed 72 metres of 1200mm diameter Ridgistorm-XL pipe along two separate runs. Ridgistorm-XL's patented electro-fusion jointing process achieved quicker and safer installation in comparison with other large diameter pipe solutions and guarantees 100% seal tightness for each joint. Ridgistorm-XL was specified for a section of this diversion due to its inherent strength and cost effectiveness when compared to traditional rigid materials. The system was installed in an enclosed concrete structure and then covered with wet-cast concrete. This then enabled the construction of a temporary road for heavy plant and vehicles to travel across the watercourse, whilst allowing the re-routed water to flow through the pipeline.



6.2 Ridgistorm-XL Electro-Fusion Joint Delivers Stormwater Diversion for Gatwick Airport Scheme

Polypipe WMS supplied a bespoke large diameter pipeline solution using its Ridgistorm-XL product for the construction of a new airside building at Gatwick Airport's North Terminal.

Ridgistorm-XL was specified by the main contractor for its electro-fusion jointing system. The existing storm drain needed to be relocated and the Ridgistorm-XL pipeline installed prior to the piling work being carried out for the new building. Concerns over the pipeline integrity as a result of the piling work were negated by using Ridgistorm-XL. The patented electro-fusion jointing method guarantees 100% seal tightness within the pipeline and is the only large diameter plastic pipe system in the UK to incorporate such technology.

Case Studies

6.3 Bespoke Large Diameter Attenuation and Rainwater Harvesting Solution for New Livestock Market

A detailed cost analysis carried out by the main contractor, on the cost-effectiveness of plastic and concrete materials resulted in Polypipe WMS re-engineering a bespoke SUDS solution for a new livestock market. Having proved that Ridgistorm-XL large diameter pipe system could achieve significant savings on the whole-cost of the project, Polypipe WMS worked closely with the contractor to design a 400 metre balanced attenuation tank with a storage capacity of one million litres, using Ridgistorm-XL large diameter pipe in 1.8 metre diameter to manage surface water run-off from all hard standing areas. In addition to the attenuation tank, Polypipe WMS also designed and fabricated a bespoke 300,000 litre rainwater harvesting solution using Ridgistorm-XL pipe in 2.1 metre diameter, to re-use rainwater from the 6,000 square metre roof area on-site. Alongside its full design and technical support service, Polypipe WMS supplied a wide variety of bespoke fabrications for the non-standard elements of the project, including bespoke 150mm stubs at intervals along the attenuation structure to connect gullies from each cattle grid. The rainwater harvesting tank also included a fabricated 'T' section that features an in-line leaf filter to prevent debris from entering the tank.

6.4 Ridgistorm-XL Large Diameter Pipe System Provides the Solution for Landfill Project

Using its patented and WRc approved pipe design software and a soil report provided by the main contractor, Polypipe WMS determined a bespoke stiffness class for the Ridgistorm-XL discharge and collection pipe that was value-engineered to meet the project specifications. Polypipe WMS engineered the solution based on the soil conditions, burial depth and installation parameters and are the only manufacturer of large diameter plastic drainage pipe with this capability.

This enabled Polypipe WMS to optimise the amount of material used to manufacture the Ridgistorm-XL pipeline, which in turn provided a more effective solution for the project.

Polypipe WMS supplied over 600 metres of its Ridgistorm-XL system in 1050mm diameter. This was installed around the perimeter of the site to manage surface water run-off from the capped areas of the landfill. Sections of the Ridgistorm-XL pipe were also perforated to collect excess stormwater for carriage through the discharge pipe. In addition to its Ridgistorm-XL large diameter pipe, Polypipe WMS also supplied over 700 metres of 300, 450 and 600mm diameter Ridgisewer and Polysewer sewerage pipe.



For recent project stories go to www.polypipewms.com/projects/.

Associated Products

A full range of complementary products including stormwater treatment filters, catchpits and flow controls, alongside bespoke solutions from our dedicated in-house Fabrications Team.

7. Associated Products

7.1 Stormcheck 'Vortex' Flow Control Chamber

The Stormcheck 'Vortex' Flow Control Chamber comprises of a pre-fabricated plastic chamber, in a range of diameters, with integral vortex flow control device. One aim of a Sustainable Drainage System is to mimic greenfield run-off rates from developed sites. One way of achieving this aim is by stormwater storage and attenuation. The new Stormcheck chamber allows precise control of site discharge rates and when combined with our storage systems provides an industry recognised flow attenuation system.



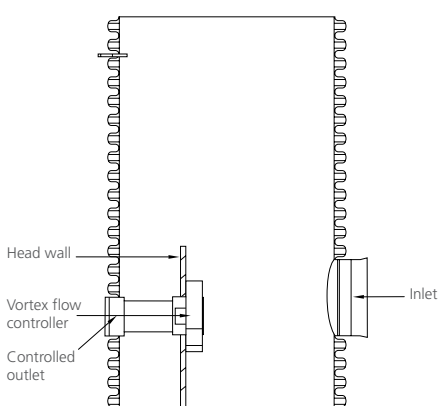
7.1.1 Key Benefits

A sealed chamber produced in our dedicated fabrications department, built to exacting specifications and delivered to site ready to be installed. Factory fitted vortex flow control device saves time and expense on-site. Vortex flow control devices are widely recognised as being the most hydraulically efficient means of flow regulation. The unique design utilising no moving parts, means they are virtually maintenance free. Stormcheck chambers are manufactured with an integral sump for silt catchment and an optional drain down system to ease maintenance and silt removal. The Stormcheck chamber can be integrated with any Polypipe SUDS solution.

7.1.2 Chamber Types

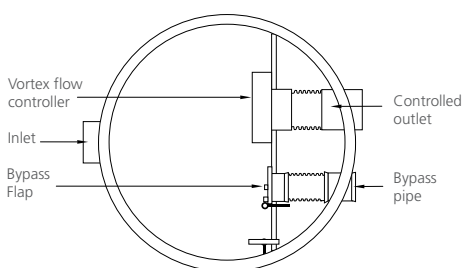
Non Bypass Chamber

For sites where discharge rates must be guaranteed and not exceeded.



Auto Bypass Design

Stormcheck chambers with automatic bypass systems are also available, please contact the Polypipe WMS Technical Team.



Manual Bypass Design

Offers a bypass to the flow control device which is manually operated from the surface. The activation of the bypass system opens a door in the head wall allowing water in the chamber to drain down via the bypass pipe.

Associated Products

7.2 Storm-X4 Stormwater Treatment System for Roof and Surface Water Run-off

Utilising the latest four-stage upward filtration technology to improve the quality of surface water run-off from roofs, car parks and the most polluted roads, even in heavily trafficked areas.

STORM-X4 is capable of cleaning surface water run-off from roofs, car parks and the most polluted roads, even in heavily trafficked areas. STORM-X4 has been designed to remove heavy particles, silt and nutrients and heavy metals such as copper, zinc and cadmium from the surface water to provide an environmentally sound solution which benefits the natural watercourse and increases biodiversity.



7.2.1 Low Maintenance

The advanced four-stage filtration system within STORM-X4 utilises no moving parts, providing a low maintenance solution for all surface water run-off applications. The filters within the unit only need to be replaced on average every two years, providing an easily maintainable solution on-site.

7.2.2 Easy to Install

Polypipe WMS can supply STORM-X4 as a standalone unit, or housed within a bespoke plastic chamber. When housed within a chamber, the units are constructed off-site and delivered to site ready to install, making installation quicker, safer and easier with a much lower development footprint.

7.3 Polystorm

By using Polystorm Lite or Polystorm, you can easily construct attenuation tanks or soakaways. The lightweight, load-bearing cells fit together to make tanks of any size or shape, providing the flexibility to meet a wide range of site restraints. Polystorm cells are used under loaded areas. Polystorm Lite cells are used under non-trafficked, landscaped areas.



7.4 Bespoke Fabricated Products

Polypipe Civils is the only plastic pipe manufacturer in the UK with its own in-house fabrications department. This unique service enables us to overcome the most difficult site constraints to create truly bespoke solutions. Our 30,000 square foot facility allows us to work in partnership with our clients to provide bespoke, pre-fabricated solutions designed to reduce time and installation costs on-site.



7.4.1 The Range

The range of products available is from standard applications to one-off bespoke solutions covering:

- Catchpits.
- Surface water and sewer manholes manufactured to adoptable standards.
- Rainwater harvesting tanks for both commercial and residential applications.
- Sediment and leaf filters pre-fabricated within chambers.
- Full range of fittings and accessories.



7.5 Technical Information Online

The Polypipe WMS website, available at www.polypipewms.co.uk includes comprehensive technical information, installation guides and CAD drawings. The ease of navigation and clear, concise information presented on the site has been designed to offer users more detailed and relevant information when looking to specify Ridgistorm-XL products. Also included within the homepage is a product search facility to give easy and direct access to the information available on the site.



The Company



The Company...

Ground breaking technology, innovative products and total solutions.



The Company

8. The Company

8.1 Innovation

Polypipe Civils has dedicated research and development facilities, supported by six years of extensive investment to set the highest standards within the industry. Our laboratories allow product development and certification testing to be undertaken in-house, therefore shortening time to market and maximising product benefits for our customers.

Product testing at independent facilities such as the UKAS accredited Berry and Hayward laboratory ensures our products, where possible, carry third-party accreditation and certification.

8.2 Manufacturing

Operating from sites in Loughborough, Horncastle and Glasgow, Polypipe Civils employs over 300 people, with 35 production lines producing over 20 different product ranges consisting in excess of 1600 individual line items. With investment levels of £11m in 2006/07 Polypipe Civils prides itself in having the most extensive manufacturing capabilities in its sector.

Polypipe Civils operates a Quality Management System which complies with the requirements of ISO9001.

8.3 Environmental Commitments

8.3.1 Sustainability is not just a Pipe Dream

Sustainability is not just about making products from recycled material, or helping to reduce energy consumption, there are many more elements to consider. Polypipe Civils makes a conscious effort to ensure as much is being done to help the external environment as possible. Products supplied to the market by Polypipe Civils are manufactured with sustainability in mind, making sure we provide sustainable solutions for generations to come. We constantly evaluate our systems and procedures so that the whole process of production is as sustainable as possible from material use through to product application.

8.3.2 Recycled Product

Using recycled product is imperative and for the past 15 years it has been our policy to use as much recycled material as possible, either from other industries or post consumer waste. To this end Polypipe Civils uses over 45% recycled material in the production of our pipes, which allows us to maintain the exacting standards of quality and durability that we strive to obtain and help protect the environment.

8.3.3 100% Recyclable

As our products are manufactured in plastic, they are 100% recyclable at the end of their useful life, creating a sustainable path back into reuse.

8.3.4 Lowering Energy Consumption

Investing in new machinery has been key to the whole Polypipe Group and we have strived to ensure that our energy consumption has been addressed to make our new machinery more energy efficient. An excellent example of this is the replacement of 17 injection moulding machines at a manufacturing site in 2006. The new machines saved between 18-20% in energy consumption over the outgoing machinery.

8.3.5 Using Less Transport

Utilising our own transport fleet, Polypipe Civils ensure that the number of vehicles delivering product to site is kept to a minimum. For example, 1km of 450mm plastic drainage pipes will only require 3 deliveries, compared to concrete pipes which would require 12 deliveries. Not only will this benefit the environment but it also minimises the risk of on-site traffic related accidents, providing further Health and Safety benefits on-site.



8.3.6 Reducing our Fuel Usage

Our transport network plays a significant role in reducing our fuel consumption and as part of this, we have made sure that our vehicles run on bio-diesel. Polypipe Civils has also adopted the use of low rolling resistance tyres saving 5% on fuel. We also limit our vehicles to 54mph as opposed to the standard 56mph to save a further 5% on fuel.

8.3.7 Recovering Site Waste

In the distribution of some products, Polypipe Civils use wooden pallets. In order to help reduce on site waste and reduce consumption we have introduced a collection scheme, whereby we collect any pallet or strapping used on our products. Collection of pallets and strapping is easy and hassle-free and can be arranged by telephone.

8.3.8 Helping our Communities

Polypipe Civils is committed to supporting our communities as much as possible. Whether it be supplying a local childrens hospice with decorations for their gardens, sponsoring youth sports teams and associations or holding one of the largest sailing regattas in the UK which brings the whole construction industry together to raise money for children in Malawi. Sustainability is about the whole environment and Polypipe Civils takes pride in helping to create a sustainable environment wherever possible.

8.4 Polypipe Health and Safety Policy

The Health and Safety of employees is an integral part of Polypipe's business activities. Health and Safety is a responsibility and statutory duty that each and every employee and visitor to our sites must share. To enable this, it is our intent that responsibility for Health and Safety be accepted and effectively carried out at all levels within our organisation.

All Polypipe Companies shall, as far as possible, ensure that:

- We provide a safe working environment for our employees, where hazard and risk are effectively assessed and eliminated or adequately controlled.
- We use suitable and sufficient controls to ensure that non-employees who may be affected by our activities are not exposed to risks to their Health and Safety.
- We meet or exceed all current legislation and regulation relating to Health and Safety.
- We clearly define and communicate organisational responsibilities for the management of Health and Safety.
- Employee involvement in matters relating to Health and Safety is actively encouraged.
- Adequate information, instruction and training are provided to all employees.
- We properly investigate accidents and cases of work-related ill health.
- We monitor and review Health and Safety performance using appropriate measures and methods.
- There are good working relationships with regulatory authorities, neighbours, customers, suppliers and stakeholders on Health and Safety.

The Company

8.5 Polypipe Environmental Policy

Polypipe Civils operates an Environmental Management System which complies with the requirements of ISO 14001

At Polypipe we consider the positive management of the potential environmental impact of our activities as an integral part of our business undertaking. It is our intent to minimise the lasting impact of our operations on the environment and to take account of sustainability in our product design and applications. The manufacture of these products consumes both raw materials and energy and Polypipe therefore has introduced proactive sustainability policies to manage both their usage and environmental impacts.

The Group shall ensure, as far as possible, that:

- We meet or exceed all current legislation and regulation relating to the environment.
- We clearly define and communicate organisational responsibilities for the management of environmental protection.
- Employee involvement in matters relating to the environment is actively encouraged.
- Adequate information, instruction and training are provided to all employees.
- We properly investigate environmental incidents.
- We monitor and review performance using appropriate measures and methods.
- We optimise the use of water and utilities.
- We take steps to reduce waste generation and disposal and increase recycling.
- There are good working relationships with regulatory authorities, neighbours, customers, suppliers and stakeholders on environmental matters. Energy Management and Conservation Policy.

Polypipe Civils operate an Environment Management System which complies with the requirements of ISO 14001.

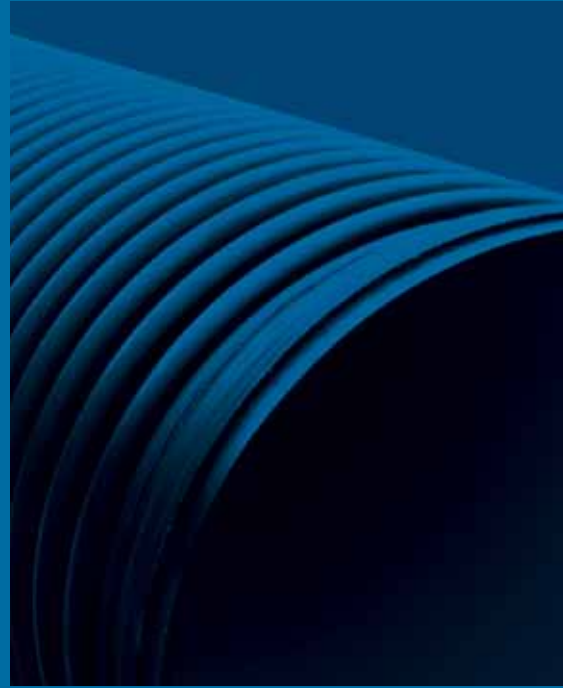


8.6 Energy Management and Conservation Policy

At Polypipe we are committed to a policy of responsible use of natural resources. We recognise the need to optimise use of and to conserve as far as possible the natural resources we consume. We therefore have implemented an Energy Management and Conservation Policy to provide a framework for achieving this objective.

All dimensions and illustrations in this publication are intended for guidance only and shall not constitute a 'sale by description'. All dimensions given are nominal and Polypipe may modify and change the information, products and specifications from time to time for a variety of reasons, without prior notice. This information in this Technical Guide is provided 'as is' at March 2009. Updates will not be issued automatically. This information is not intended to have any legal effect, whether by way of advice, representation or warranty (express or implied). We accept no liability whatsoever (to the extent permitted by law) if you place any reliance on this Technical Guide you must do so at your own risk. All rights reserved. Copyright in this publication belongs to Polypipe and all such copyright may not be used, sold, copied or reproduced in whole or part in any manner or in any media to any person without prior consent. © Polypipe is a registered Trademark of Polypipe. All Polypipe products are protected by Design Right under CDPA 1988. Copyright © 2008 Polypipe. All rights reserved.

Ridgistorm-XL Technical Manual



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 **Polypipe**